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RED LAKE SALT CAVERN GAS STORAGE PROJECT

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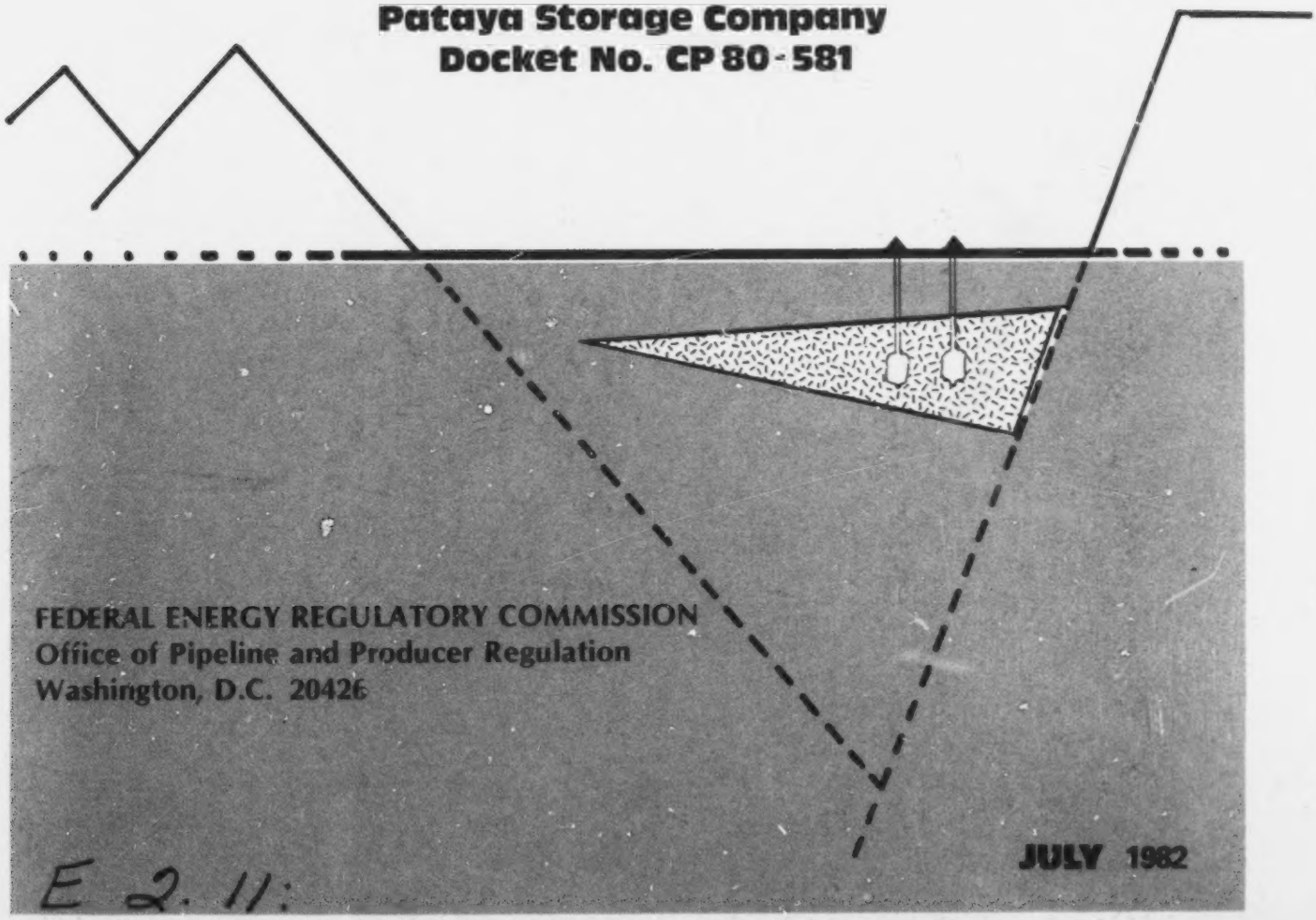
Final Environmental Impact Statement

Pataya Storage Company
Docket No. CP 80-581



FEDERAL ENERGY REGULATORY COMMISSION
Office of Pipeline and Producer Regulation
Washington, D.C. 20426

JULY 1982

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July 1982

FERC/EIS-0028

RED LAKE SALT CAVERN GAS STORAGE PROJECT

Final Environmental Impact Statement

Pataya Storage Company
Docket No. CP80-581

This Final Environmental Impact Statement (FEIS) analyzes the environmental effects of the proposed Red Lake Gas Storage System in Mohave County, Arizona, a gas storage field composed of two subsurface solution-mined salt cavities, 30 miles of 16-inch diameter gas pipeline, four 325-kilowatt generators, 5,400 horsepower of compression, appurtenant site access roads, and brine evaporation ponds. The facility would be designed to store 3 billion cubic feet of usable natural gas and to transport that gas through the proposed and existing pipeline facilities to customers in Arizona and southern Nevada.

The Department of the Interior, Bureau of Land Management, has permit authority over rights-of-way which cross Federal land and is a cooperating agency in preparing this FEIS.

Anyone desiring to file a petition to intervene with the Commission on the basis of this FEIS should do so in accordance with the requirements of the FERC's rules of Practice and Procedure, 18 CFR Part 1.8 and 1.10.

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Federal Energy Regulatory Commission
Office of Pipeline and Producer Regulation
Washington, D.C. 20426

FEDERAL POWER COMMISSION-ORDER 415-C
(Issued December 18, 1972)
STATEMENT OF GENERAL POLICY TO IMPLEMENT PROCEDURES FOR COMPLIANCE WITH THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969

§ 2.80 Detailed Environmental Statement.

(a) It shall be the general policy of the Federal Power Commission to adopt and to adhere to the objectives and aims of the National Environmental Policy Act of 1969 (Act) in its regulation under the Federal Power Act and the Natural Gas Act. The National Environmental Policy Act of 1969 requires, among other things, all Federal agencies to include a detailed environmental statement in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment.

(b) Therefore, in compliance with the National Environmental Policy Act of 1969 the Commission staff shall make a detailed environmental statement when the regulatory action taken by us under the Federal Power Act and Natural Gas Act will have a significant environmental impact. A "detailed statement" prepared in compliance with the requirements of §§ 2.81 through 2.82 of this Part shall fully develop the five factors listed hereinafter in the context of such considerations as the proposed activity's direct and indirect effect on the air and water environment of the project or natural gas pipeline facility, on the land, air, and water biota; on established park and recreational areas; and on sites of natural, historic, and scenic values and resources of the area. The statement shall discuss the extent of the conformity of the proposed activity with all applicable environmental standards. The statement shall also fully deal with alternative courses of action to the proposal and, to the maximum extent practicable, the environmental effects of each alternative. Further, it shall specifically discuss plans for future development related to the application under consideration.

The above factors are listed to merely illustrate the kinds of values that must be considered in the statement. In no respect is this listing to be construed as covering all relevant factors.

The five factors which must be specifically discussed in the detailed statement are:

(1) the environmental impact of the proposed action,
(2) any adverse environmental effects which cannot be avoided should the proposal be implemented;
(3) alternatives to the proposed action,
(4) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
(5) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

(c) (i) To the maximum extent practicable no final administrative action is to be taken sooner than ninety days after a draft environmental statement has been circulated for comment or thirty days after the final text of an environmental statement has been made available to the Council on Environmental Quality and the public.

(c) (ii) Upon a finding that it is necessary and appropriate in the public interest, the Commission may dispense with any time period specified in §§ 2.80-2.82.

§ 2.81 Compliance with the National Environmental Policy Act of 1969 under Part I of the Federal Power Act

(a) All applications for major projects (those in excess of 2,000 horsepower) or for reservoirs only providing regulatory flows to downstream (major) hydroelectric projects under Part I of the Federal Power Act for license or relicense, shall be accompanied by Exhibit W, the applicant's detailed report of the environmental factors specified in § 2.80 and 4.41. All applications for surrender or amendment of a license proposing construction, or operating change of a project shall be accompanied by the applicant's detailed report of the environmental factors specified in § 2.80. Notice of all such applications shall continue to be made as prescribed by law.

(b) The staff shall make an initial review of the applicant's report and, if necessary, require applicant to correct deficiencies in the report. If the proposed action is determined to be a major Federal action significantly affecting the quality of the human environment, the staff shall conduct a detailed independent analysis of the action and prepare a draft environmental impact statement which shall be made available to the Council on Environmental Quality, the Environmental Protection Agency, other appropriate governmental bodies, and to the public, for comment. The statement shall also be served on all parties to the proceeding. The Secretary of the Federal Power Commission shall cause prompt publication in the Federal Register of notice of the availability of the staff's draft environmental statement. Written comments shall be made within 45 days of the date the notice of availability appears in the Federal Register. If any governmental entity, Federal, state, or local, or any member of the public, fails to comment within the time provided, it shall be assumed, absent a request for a specific extension of time, that such entity or person has no comment to make. Extensions of time shall be granted only for good cause shown. All entities filing comments with the Commission will submit ten copies of such comments to the Council on Environmental Quality. Upon expiration of the time for comment the staff shall consider all comments received and revise as necessary and finalize its environmental impact statement which, together with the comments received, shall accompany the proposal through the agency review and decision-making process and shall be made available to the parties to the proceeding, the Council on Environmental Quality, and the public. In the event the proposal is the subject of a hearing the staff's environmental statement will be placed in evidence at that hearing.

(c) Any person may file a petition to intervene on the basis of the staff draft environmental statement. All interveners taking a position on environmental matters shall file timely comments, in accordance with paragraph (b) of this section, on the draft statement with the Commission including, but not limited to, an analysis of their environmental position in the context of the factors enumerated in § 2.80, and specifying any differences with staff's position upon which intervener wishes to be heard. Nothing herein shall preclude an intervener from filing a detailed environmental impact statement.

(d) In the case of each contested application, the applicant, staff, and all interveners taking a position on environmental matters shall offer evidence for the record in support of their environmental position. The applicant and all such interveners shall specify any differences with the staff's position, and shall include, among other relevant factors, a discussion of their position in the context of the factors enumerated in § 2.80.

(e) In the case of each contested application, the initial and reply briefs filed by the applicant, the staff and all interveners taking a position on environmental matters must specifically analyze and evaluate the evidence in the light of the environmental criteria enumerated in § 2.80. Furthermore, the Initial Decision of the Presiding Administrative Law Judge in such cases, and the final order of the Commission dealing with the application on the merits in all cases, shall include an evaluation of the environmental factors enumerated in § 2.80 and the views and comments expressed in conjunction therewith by the applicant and all those making formal comment pursuant to the provisions of this section.

§ 2.82 Compliance with the National Environmental Policy Act of 1969 Under the Natural Gas Act.

(a) All certificate applications filed under Section 7(c) of the Natural Gas Act (15 U.S.C. 717f(c)) for the construction of pipeline facilities, except abbreviated applications filed pursuant to Sections 157.7(b), (c) and (d) of Commission Regulations and producer applications for the sale of gas filed pursuant to Sections 157.23-29 of Commission Regulations, shall be accompanied by the applicant's detailed report of the environmental factors specified in § 2.80. Notice of all such applications shall continue to be made as prescribed by law.

(b) The staff shall make an initial review of the applicant's report and, if necessary, require applicant to correct deficiencies in the report. If the proposed action is determined to be a major Federal action significantly affecting

the quality of the human environment, the staff shall conduct a detailed independent analysis of the action and prepare a draft environmental impact statement which shall be made available to the Council on Environmental Quality, the Environmental Protection Agency, other appropriate governmental bodies, and to the public, for comment. The statement shall also be served on all parties to the proceeding. The Secretary of the Federal Power Commission shall cause prompt publication in the Federal Register of notice of the availability of the staff's draft environmental statement. Written comments shall be made within 45 days of the date the notice of availability appears in the Federal Register. If any governmental entity, Federal, state, or local, or any member of the public, fails to comment within the time provided, it shall be assumed, absent a request for a specific extension of time, that such entity or person has no comment to make. Extensions of time shall be granted only for good cause shown. All entities filing comments with the Commission shall submit ten copies of such comments to the Council on Environmental Quality. Upon expiration of the time for comment the staff shall consider all comments received and revise as necessary and finalize its environmental impact statement which, together with the comments received, shall accompany the proposal through the agency review and decision-making process and shall be made available to the parties to the proceeding, the Council on Environmental Quality, and the public. In the event the proposal is the subject of a hearing, the staff's environmental statement will be placed in evidence at that hearing.

(c) Any person may file a petition to intervene on the basis of the staff draft environmental statement. All intervenors taking a position on environmental matters shall file timely comments, in accordance with paragraph (b) of this section, on the draft statement with the Commission including, but not limited to, an analysis of their environmental position in the context of the factors enumerated in § 2.80, and specifying any differences with staff's position upon which intervenor wishes to be heard. Nothing herein shall preclude an intervenor from filing a detailed environmental impact statement.

(d) In the case of each contested application, the applicant, staff, and all intervenors taking a position on environmental matters shall offer evidence for the record in support of their environmental position. The applicant and all such intervenors shall specify any differences with the staff's position, and shall include, among other relevant factors, a discussion of their position in the context of the factors enumerated in §2.80.

(e) In the case of each contested application, the initial and reply briefs filed by the applicant, the staff, and all intervenors taking a position on environmental matters must specifically analyze and evaluate the evidence in the light of the environmental criteria enumerated in § 2.80. Furthermore, the Initial Decision of the Presiding Administrative Law Judge in such cases, and the final order of the Commission dealing with the application on the merits in all cases, shall include an evaluation of the environmental factors enumerated in § 2.80 and the views and comments expressed in conjunction therewith by the applicant and all those making formal comment pursuant to the provisions of this section.

FEDERAL POWER COMMISSION
RULES OF PRACTICE AND PROCEDURE
18 CFR 1.8 Intervention

"(a) Initiation of intervention. Participation in a proceeding as an intervenor may be initiated as follows:

(1) By the filing of a notice of intervention by a State Commission, including any regulatory body of the State or municipality having jurisdiction to regulate rates and charges for the sale of electric energy, or natural gas, as the case may be, to consumers within the intervening State or municipality.

(2) By order of the Commission upon petition to intervene.

(b) Who may petition. A petition to intervene may be filed by any person claiming a right to intervene or an interest of such nature that intervention is necessary or appropriate to the administration of the statute under which the proceeding is brought. Such right or interest may be:

(1) A right conferred by statute of the United States;

(2) An interest which may be directly affected and which is not adequately represented by existing parties and as to which petitioners may be bound by the Commission's action in the proceeding (the following may have such an interest; consumers served by the applicant, defendant, or respondent; holders of securities of the applicant, defendant, or respondent; and competitors of the applicant, defendant, or respondent).

(3) Any other interest of such nature that petitioner's participation may be in the public interest.

(c) Form and contents of petitions. Petitions to intervene shall set out clearly and concisely the facts from which the nature of the petitioner's alleged right or interest can be determined, the grounds of the proposed intervention, and the position of the petitioner in the proceeding, so as fully and completely to advise the parties and the Commission as to the specific issues of fact or law to be raised or controverted, by admitting, denying or otherwise answering specifically and in detail, each material allegation of fact or law asserted in the proceeding, and citing by appropriate reference the statutory provisions or other authority relied on: Provided, that where the purpose of the proposed intervention is to obtain an allocation of natural gas for sale and distribution by a person or municipality engaged or legally authorized to engage in the local distribution of natural or artificial gas to the public, the petition shall comply with the requirements of Part 154 of this chapter (i.e., Regulations Under the Natural Gas Act). Such petitions shall in other respects comply with the requirements of §§ 1.18 to 1.17, inclusive.

(d) Filing and service of petitions. Petitions to intervene and notices of intervention may be filed at any time following the filing of a notice of rate or tariff change, or of an application, petition, complaint, or other document seeking Commission action, but in no event later than the date fixed for the filing of petitions to intervene in any order or notice with respect to the proceedings issued by the Commission or its Secretary, unless, in extraordinary circumstances for good cause shown, the Commission authorizes a late filing. Service shall be made as provided in §1.17. Where a person has been permitted to intervene notwithstanding his failure to file his petition within the time prescribed in this paragraph, the Commission or officer designated to preside may where the circumstances warrant, permit the waiver of the requirements of §1.20(c)(3) with respect to copies of exhibits for such intervenor.

(e) Answers to petitions. Any party to the proceeding or staff counsel may file an answer to a petition to intervene, and in default thereof, may be deemed to have waived any objection to the granting of such petition. If made, answers shall be filed within 10 days after the date of service of the petition, but not later than 5 days prior to the date set for the commencement of the hearing, if any, unless for cause the Commission with or without motion shall perscribe a different time. They shall in all other respects conform to the requirements of §§1.18 to 1.17, inclusive.

(f) Notice and action on petitions

(1) Notice and service. Petitions to intervene, when tendered to the Commission for filing, shall show service thereof upon all participants to the proceeding in conformity with §1.17(b).

(2) Action on petitions. As soon as practicable after the expiration of the time for filing answers to such petitions or default thereof, as provided in paragraph (e) of this section, the Commission will grant or deny such petition in whole or in part or may, if found to be appropriate, authorize limited participation. No petitions to intervene may be filed or will be acted upon during a hearing unless permitted by the Commission after opportunity for all parties to object thereto. Only to avoid detriment to the public interest will any presiding officer tentatively permit participation in a hearing in advance of, and then only subject to, the granting by the Commission of a petition to intervene.

(g) Limitation in hearings. Where there are two or more intervenors having substantially like interests and positions, the Commission or presiding officer may, in order to expedite the hearing, arrange appropriate limitations on the number of attorneys who will be permitted to cross-examine and make and argue motions and objections on behalf of such intervenors."

SUMMARY

1. This final environmental impact statement (FEIS), prepared by the staff of the Federal Energy Regulatory Commission, is related to an administrative action.

2. This administrative action arises from an application filed by Pataya Storage Company in Docket No. CP80-581 for a certificate of public convenience and necessity authorizing, pursuant to section 7(c) of the Natural Gas Act, the construction and operation of a natural gas storage plant near Red Lake in Mohave County, Arizona. Facilities would include two subsurface solution mined salt cavities, 30 miles of 16-inch diameter gas pipeline, four 325-kilowatt electric generators, 5,400 horsepower of compression, appurtenant site access roads, and a brine evaporation pond.

3. The FEIS assesses the environmental impact of the proposed project and the feasibility of various other alternatives. The environmental staff has examined the potential effects on soils, geology, water, land use, recreation, aesthetic qualities, air quality, noise levels, vegetation, wildlife, cultural resources, and socioeconomic conditions.

4. In general, the construction and operation of the proposed project would have limited adverse environmental impact.

   The design of the caverns is based on results of mechanical and chemical analyses of salt samples taken from a well approximately 1-mile east of the proposed cavern site. These data will have to be verified by testing site-specific core samples. Until that information becomes available (i.e., after the proposed cavern wells are drilled), the suitability of the proposed site and design cannot be determined. Currently available geologic data suggest that natural and induced conditions would minimize the possibility of extensive aquifer contamination.

5. The staff recommends implementation of several mitigating measures and monitoring programs as conditions to the certificate, should the Commission approve the project. Recommended monitoring programs would provide data necessary for more definitive impact analysis of the operation of the proposed project and more expedient environmental review of any facility expansion.

6. Before construction of the facilities can begin, the applicant must acquire permits from the U.S. Department of the Interior and the U.S. Environmental Protection Agency. State and local agencies must also issue permits before construction may take place in specific areas.

7. The Department of the Interior, Bureau of Land Management, has prepared an environmental impact assessment of the proposed gas pipeline route across Federal land. The necessary right-of-way has been granted with stipulations. BLM's assessment and its stipulations for Federal land, which appear as appendix A, are adopted as part of this FEIS. BLM is currently reviewing a separate application for the necessary plant access road right-of-way.

8. Comments on the DEIS from Federal, state, and local agencies and other interested parties were filed with the Secretary, Federal Energy Regulatory Commission. All comments received by the staff were considered in preparing the FEIS. They are included in this volume, along with the staff's responses, as appendix G.

9. Copies of this FEIS are being made available to the public and to all parties in this proceeding, and to the following on or about July 16, 1982.

FEDERAL

Advisory Council on Historic Preservation
Council on Environmental Quality
Department of Agriculture
Department of Commerce
Department of Defense
Department of Energy
Department of Health and Human Services
Department of Housing and Urban Development
Department of the Interior
Department of Labor
Department of State
Department of Transportation
Environmental Protection Agency
Federal Trade Commission
Representative Robert Stump
Senator Barry Goldwater
Senator Dennis DeConcini

ARIZONA

Agriculture and Horticulture Department
Arizonans for Jobs and Energy

Atomic Energy Commission
Center for Public Affairs
Corporation Commission
Department of Health Services
Department of Transportation
Game and Fish Department
Labor Department
Land Department
Mineral Resources Department
Natural Heritage Program
Office of Economic Planning and Development
Office of the State Mine Inspector
Oil and Gas Conservation Commission
Power Authority
State Clearinghouse
State Museum
State Parks Board
Water Commission

NEVADA

Public Service Commission

LOCAL AGENCIES AND GROUPS

City of Kingman
District IV Council of Governments
Dolan Springs Chamber of Commerce
Kingman Fire Department
Mohave County Board of Supervisors
Mohave County Extension Service
Mohave County Planning and Zoning Commission
Mohave Livestock Association

SPECIAL INTEREST GROUPS

American Conservation Association, Inc.
American Gas Association
American Petroleum Institute
American Scenic and Historic Preservation Society
Arizona Geological Society
Conservation and Resource Foundation, Inc.
Conservation Foundation
Environmental Action
Environmental Defense Fund
Environmental Law Institute
Environmental Policy Center
Friends of the Earth

National Association of Conservation Districts
National Audubon Society
National Wildlife Federation
Natural Resources Council of America
Natural Resources Defense Council, Inc.
North American Landsailing Association
North American Wildlife Foundation
Sierra Club
The Nature Conservancy
The Wilderness Society

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ABBREVIATIONS AND ACRONYMS

BACT--best available control technology

Bcf--billion cubic feet

BLM--Bureau of Land Management

Btu--British thermal unit

cfd--cubic feet per day

cfs--cubic feet per second

CP National--CP National Corporation

CWC--Carson Water Company

dB(A)--decibels on the A-weighted scale

DOT--U.S. Department of Transportation

EIS--environmental impact statement

El Paso--El Paso Natural Gas Company

EPA--U.S. Environmental Protection Agency

ESD--emergency shutdown

FERC--Federal Energy Regulatory Commission

FWS--Fish and Wildlife Service

gpm--gallons per minute

GSL--Great Salt Lake Minerals and Chemicals Corporation

Kermac--Kerr-McGee Corporation

kV--kilovolts

L_{dn}--day-night sound level

L_{eq}--average sound level equivalent

LMA--labor market area

LNG--liquefied natural gas

LPG--liquefied petroleum gas

µg--microgram

$\mu g/m^3$--micrograms per cubic meter

mg/l--milligrams per liter

mg/m^3--milligrams per cubic meter

MP--milepost

NAAQS--National Ambient Air Quality Standards

NALSA--North American Land-sailing Association

NO_2--nitrogen dioxide

Northwest--Northwest Pipeline Corporation

Pataya--Pataya Storage Company

ppm--parts per million

PSD--prevention of significant air quality deterioration

psia--pounds per square inch absolute

Sierra Pacific--Sierra Pacific Power Company

SO_2--sulfur dioxide

Southwest--Southwest Gas Corporation

Southwest Salt--Southwest Salt Company

Stauffer--Stauffer Chemical Company

TSP--total suspended particulates

USDA--U.S. Department of Agriculture

CHAPTER ONE
PURPOSE AND NEED FOR ACTION

The Pataya Storage Company (Pataya) a wholly owned subsidiary of Southwest Gas Corporation (Southwest) has filed an application before the Federal Energy Regulatory Commission (FERC) for a certificate of public convenience and necessity pursuant to section 7(c) of the Natural Gas Act. If approved, Pataya would construct and operate an underground natural gas storage facility in the vicinity of Red Lake, Mohave County, Arizona. Figure 1 shows the location of the proposed facility. The total estimated cost of the proposal would be $54.3 million.

The U.S. Department of the Interior, Bureau of Land Management (BLM), which has permit authority over rights-of-way that cross Federal lands, is a cooperating agency in preparing this final environmental impact statement (EIS). (Affected Federal lands are shown in figure 26.) BLM has prepared an independent impact assessment of the proposed pipeline route which is incorporated into this FEIS as appendix A.

Using two solution-mined subsurface caverns within a previously identified halite (salt) deposit beneath Hualapai Valley, Pataya would store natural gas under pressure during periods of low demand and deliver it to customers during periods of high demand. In addition, Pataya requests authorization to provide Southwest with up to 100 million cubic feet per day (cfd) of natural gas and a total of 3 billion cubic feet (Bcf) annually. Southwest purchases, transmits, and distributes natural gas in Nevada, Arizona, and California. Its service area includes most of the populated areas of Nevada, sections of southern, central, and northwestern Arizona, and portions of California, including Lake Tahoe and the high desert and mountain areas in San Bernardino County.

In northern Nevada and northern California, Southwest provides gas directly to 36,000 customers and offers wholesale gas service to the Sierra Pacific Power Company (Sierra Pacific), which distributes natural gas in Reno and Sparks and the surrounding area, and to CP National Corporation (CP National), which distributes natural gas in portions of Eldorado County, California, at the southern end of Lake Tahoe. Sierra Pacific and CP National provide service to 62,000 customers in Nevada and California. Southwest distributes gas directly to 82,000 customers in Las Vegas and surrounding communities and wholesales gas to CP National to serve an additional 45,000 customers in Henderson, Nevada. In southern California, Southwest distributes gas to approximately 40,000 customers.

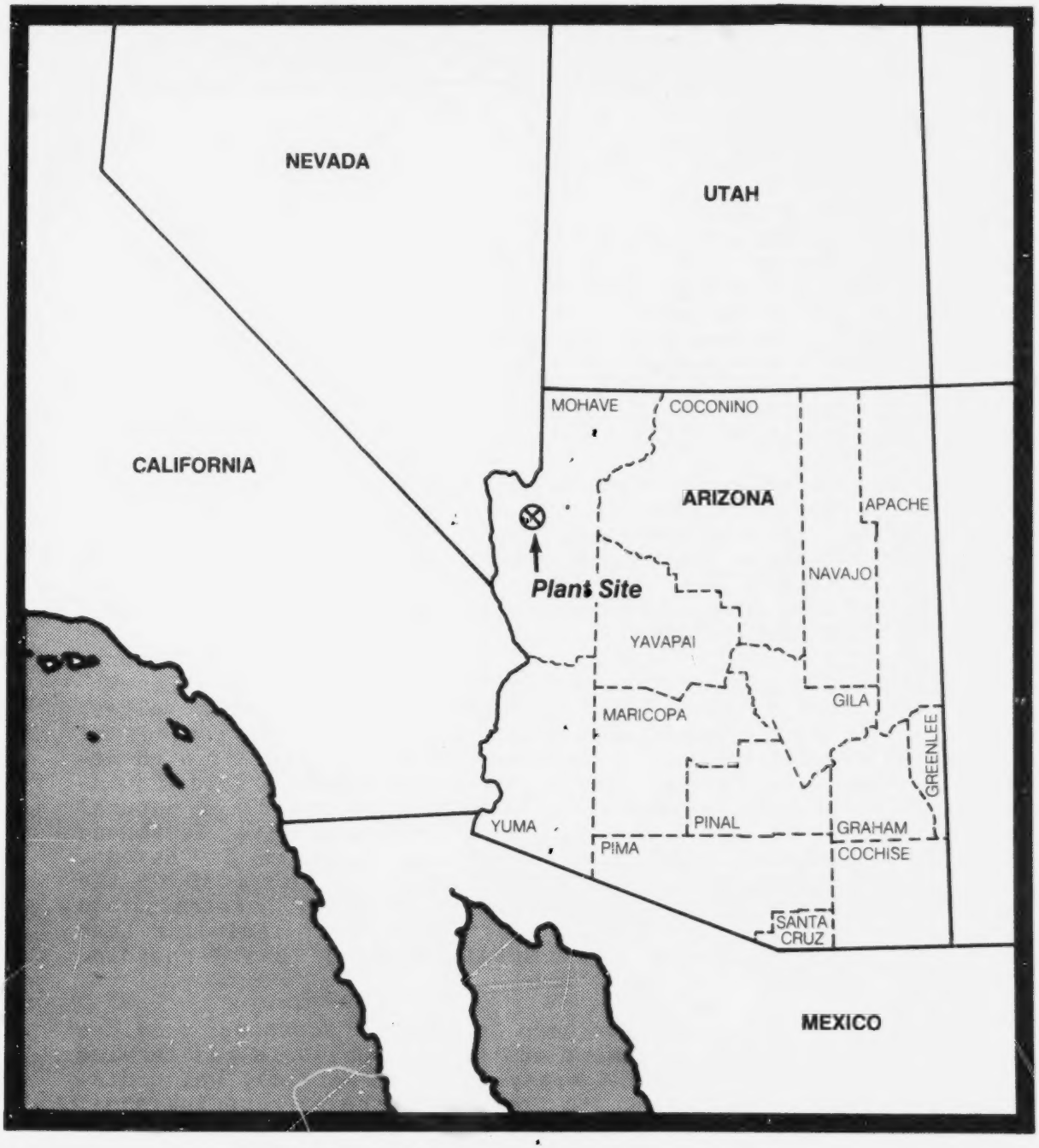


Figure 1
Location of Proposed Project

Southwest previously supplied natural gas to 23,000 customers in Gila, Pinal, Greenlee, and Mohave Counties, in Arizona. On April 1, 1979, Southwest acquired all of the gas utility assets of the Tucson Electric Power Company and expanded its service areas in Arizona to include Tucson, South Tucson, and certain unincorporated areas in Pima and Pinal Counties. Southwest presently distributes gas to 167,000 customers in Arizona.

Southwest currently purchases its base supply for its Arizona and southern Nevada systems from El Paso Natural Gas Company (El Paso). Southwest's southern California gas requirements are purchased from the Pacific Gas and Electric Company, and gas for the company's northern Nevada and California systems is purchased from the Northwest Pipeline Corporation (Northwest).

Since 1973, Southwest has been forced to curtail gas deliveries to its low priority industrial and powerplant customers which receive their base supply from El Paso because insufficient gas is available from El Paso during certain periods of high demand. El Paso's long-range gas supply forecasts indicate continued and increasing curtailments of Southwest's industrial and powerplant customers. The applicant has projected curtailment of its high priority residential and commercial customers as early as 1985.

Since 1975, Southwest has been developing supplemental sources of gas supply for its service areas in Arizona and southern Nevada to maintain high levels of service to its industrial and powerplant customers and to protect the continued growth of its residential and commercial customers. Southwest can purchase supplemental natural gas for Arizona and southern Nevada at the wellhead, from independent producers in Utah, Colorado, and New Mexico, from intrastate suppliers, from Canadian gas supplied by Northwest, and through specific seasonal contract purchases. In addition, Southwest may purchase gas from its Northern Nevada Division, which is currently constructing a liquefied natural gas (LNG) peak-shaving facility near Lovelock, Nevada. This facility was authorized by the Commission in Docket No. CP78-221.

The proposed storage facilities would help provide a dependable, year-round natural gas supply for Southwest's customers in Arizona and southern Nevada. The storage facility could also supply gas to Southwest's northern system by transporting gas through El Paso's pipeline to a connection with Northwest's system at Ignacio, Colorado. The volumes of gas contracted to Southwest exceed the requirements of its customer demands during low demand periods of the year. The excess volumes are presently sold so that Southwest can maintain a high load-factor. Southwest now proposes to store some of these volumes in the Pataya facility for use during high demand periods. The proposed storage facilities would therefore be used to eliminate possible gas curtailments of high

priority customers during high demand or gas shortage. Additionally, when Southwest is able to supply all the needs of its high priority customers, the proposed storage volumes would be used to supply the lower priority (industrial and powerplant requirements of its customers.

As with other major projects, the need for the proposed facilities, market for the gas supply, gas supply issues, and other matters related to the public convenience and necessity are being fully examined by other technical staff of the FERC and may be the subject of formal FERC evidentiary hearings. Under section 7(c) of the Natural Gas Act and its implementing regulations, the FERC has sole responsibility for determining that interstate gas facilities are in the public interest. If the FERC determines that there is or will be a need for a proposed service, it will issue a certificate of public convenience and necessity that authorizes the Red Lake Gas Storage Project. Until the FERC makes a decision based on a fully developed record, which includes consideration of the environmental impact of the proposal, as required by the National Environmental Policy Act of 1969, the need for the proposed project has not been established.

CHAPTER TWO
PROPOSED ACTION AND ALTERNATIVES

A. PROPOSED FACILITIES

The proposed plant would be approximately 30 miles north of Kingman, Arizona, on the relatively flat surface of Hualapai Valley, an intermontane alluvial basin bounded by the Cerbat Mountains to the west and the Grand Wash Cliffs of the Colorado Plateau to the east. The facilities, shown in figure 2, would include two storage caverns, brine evaporation ponds, 30 miles of 16-inch diameter pipeline, a 5,400-horsepower compressor station, and four 325-kilowatt electric power generators. The storage system is designed for an injection rate of 50 million cfd and withdrawal of 100 million cfd. The cavern site and compressor station, shown in figure 3, would occupy approximately 20 acres. However, with the proposed evaporation pond, borrow pits, access roads, and pipeline right-of-way, approximately 1,200 acres would be affected.

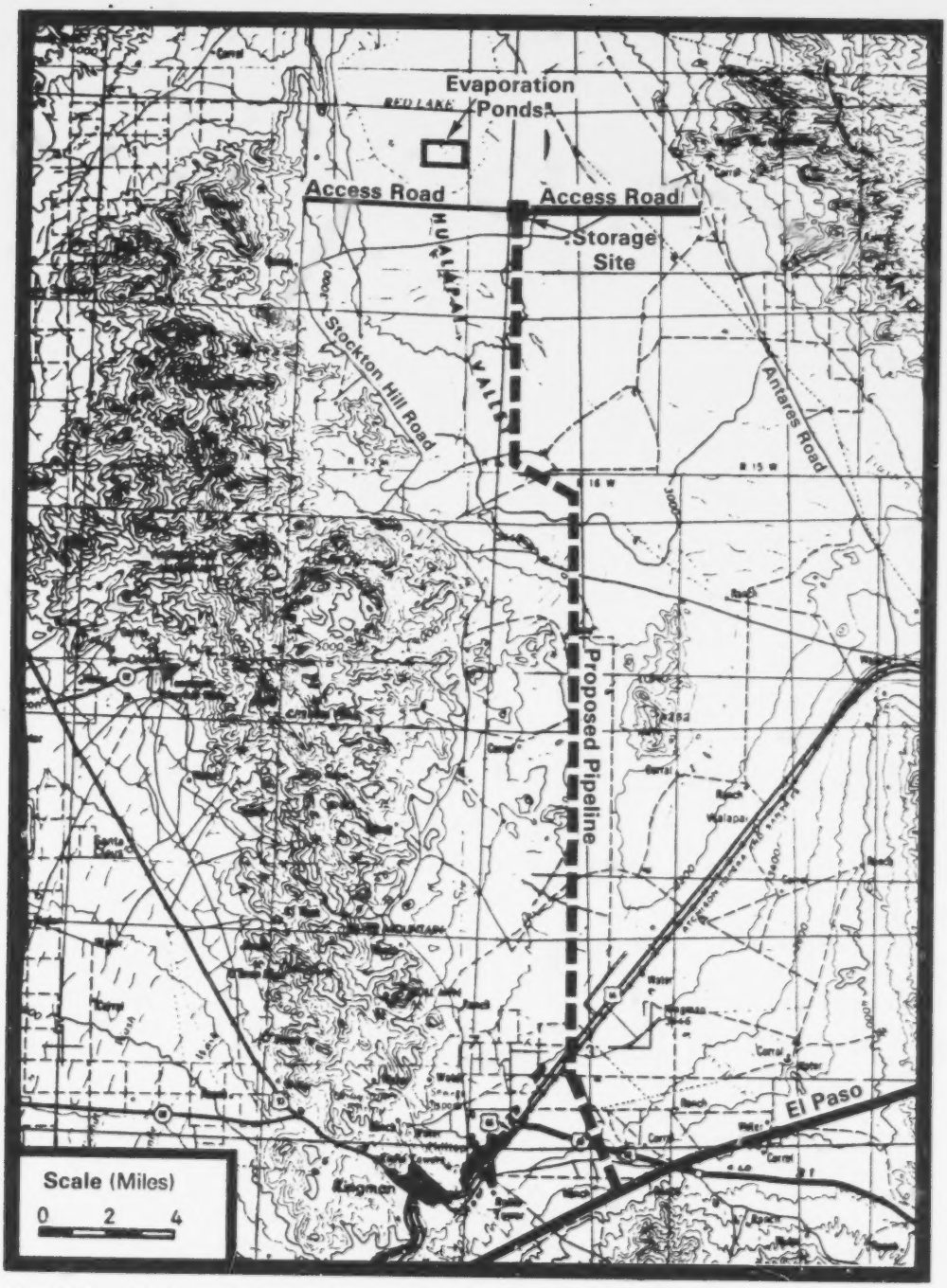
1. Construction

a) Subsurface Cavern System

Pataya proposes to construct two caverns with diameters of approximately 150 feet and usable heights of 1,000 feet by leaching--circulating fresh water through a well bore, thereby dissolving a chamber in the salt. The total combined active cavern volume would equal approximately 23 million cubic feet.

The presently proposed cavern design is based on calculations using a two-dimensional model for solution mining simulation. This model was developed in 1976 by the Solution Mining Research Institute of Woodstock, Illinois, and has been successfully used in other cavern projects. However, the final design of the storage caverns and leaching methods to be used would depend on the structural, mechanical, and chemical characteristics of the salt at the cavern site.

At present, knowledge of the material characteristics of the salt body is based on salt cores taken from an exploratory well drilled by El Paso. The proposed cavern wells would be drilled approximately 1 mile west of the El Paso well. Therefore, any correlation between the physical properties of salt from that well



Adapted from U.S. Geological Survey Topographic Maps, Kingman and Williams Sheets. Scale 1:250,000.

Figure 2
Proposed Facilities

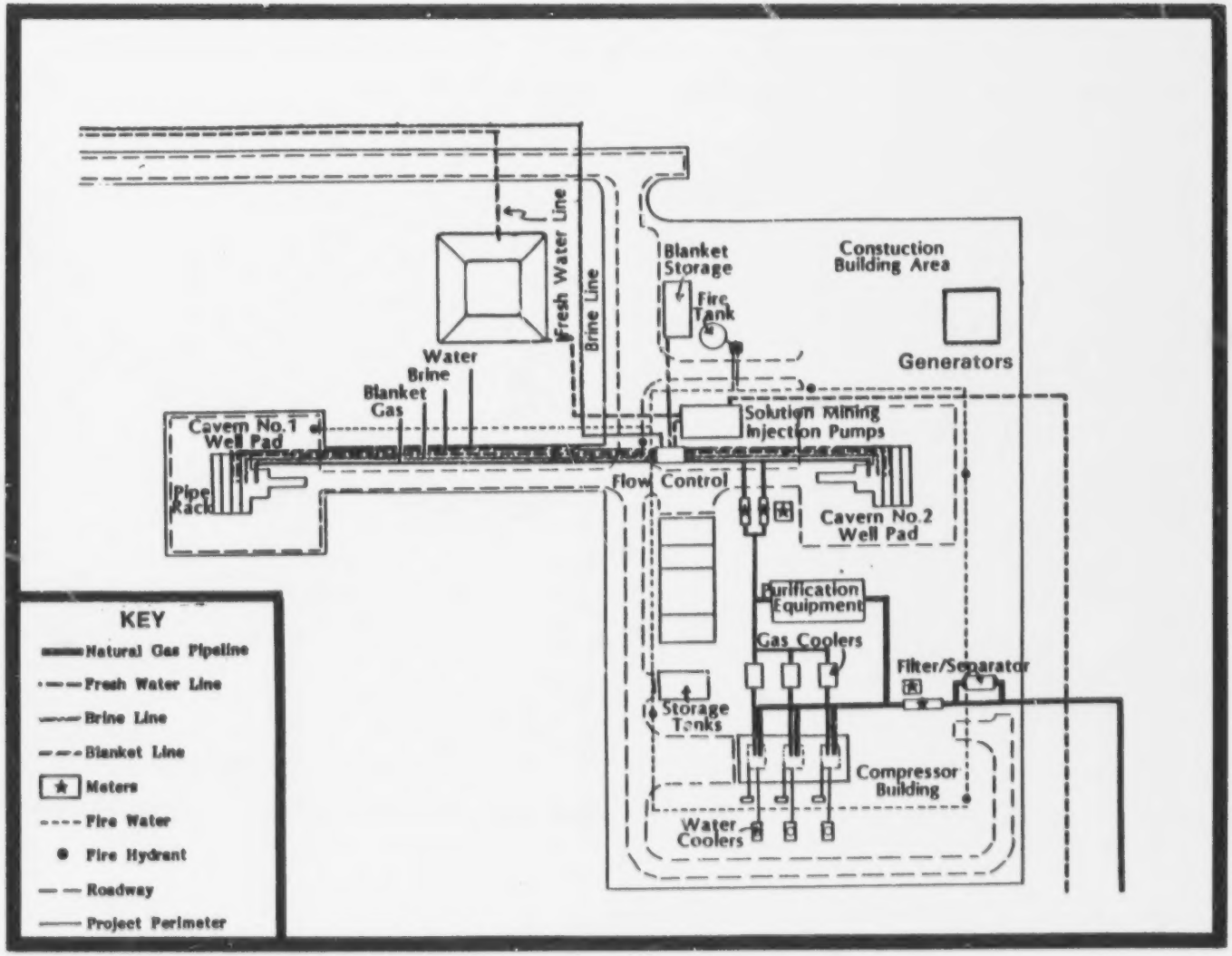


Figure 3
Plot Plan of Proposed Cavern Site

and the proposed cavern well must be considered tentative. When the cavern wells are drilled, cores totaling approximately 10 percent of the salt section would be taken. This material would then be analyzed for its chemical, mineralogical, and mechanical properties. The actual number of cores and the extent of analysis would be determined by a solution mining engineer from the information and data gathered during the well drilling.

Following the initial clearing, grading, and emplacement of engineered fill at the site, a standard, self-contained, mobile rotary drilling rig would drill bore holes 5,300 feet deep into the salt deposit. Standard operating procedures, including the use of drilling fluid (mud) systems and casing setting techniques, would be followed. Next, solution mining wellheads (shown in figure 4) with three coaxial pipe strings would be installed and connected to water-injection piping, brine transfer lines, and a liquefied petroleum gas (LPG) blanket system. Since it is less dense than brine, LPG would invade the space near the roof of the cavern and protect it from further leaching. This procedure would allow the operator to control the vertical extent of leaching and therefore the position and shape of the cavern within the salt body.

Water from the local well system would be pumped into a freshwater feed pond, piped to leaching pumps and pumped down the solution-mining wellheads, then injected into the bore space at a rate of approximately 1,500 gallons per minute (gpm) per well. The dimensions of the caverns would be controlled by positioning the leaching tubing and LPG blanket and using direct and indirect leaching methods, illustrated in figure 5. As water was injected into the cavern, brine would be displaced through the leaching string to the surface and transported through buried pipeline to the evaporation pond. Periodically, the solution mining would be halted and a sonar device inserted to accurately determine the dimensions of the cavern. The position of the leaching tubing and direction of water injection would be adjusted as necessary.

The caverns would be developed over 14 months. After the final phase of development, a pressure test would be conducted to confirm that the caverns and casings were structurally sound before the caverns were filled with natural gas. Then the solution-mining wellhead would be modified to allow for gas injection. (See figure 4 for an illustration of the storage wellhead.)

b) Brine Evaporation Pond

Continuous injection of fresh water into the caverns (approximately 4,000 acre feet or 1.31 billion gallons during solution mining) would displace approximately 1.46 billion gallons of brine to the surface through the leaching tubing. After passing through the flow-control equipment, the brine solution would be directed

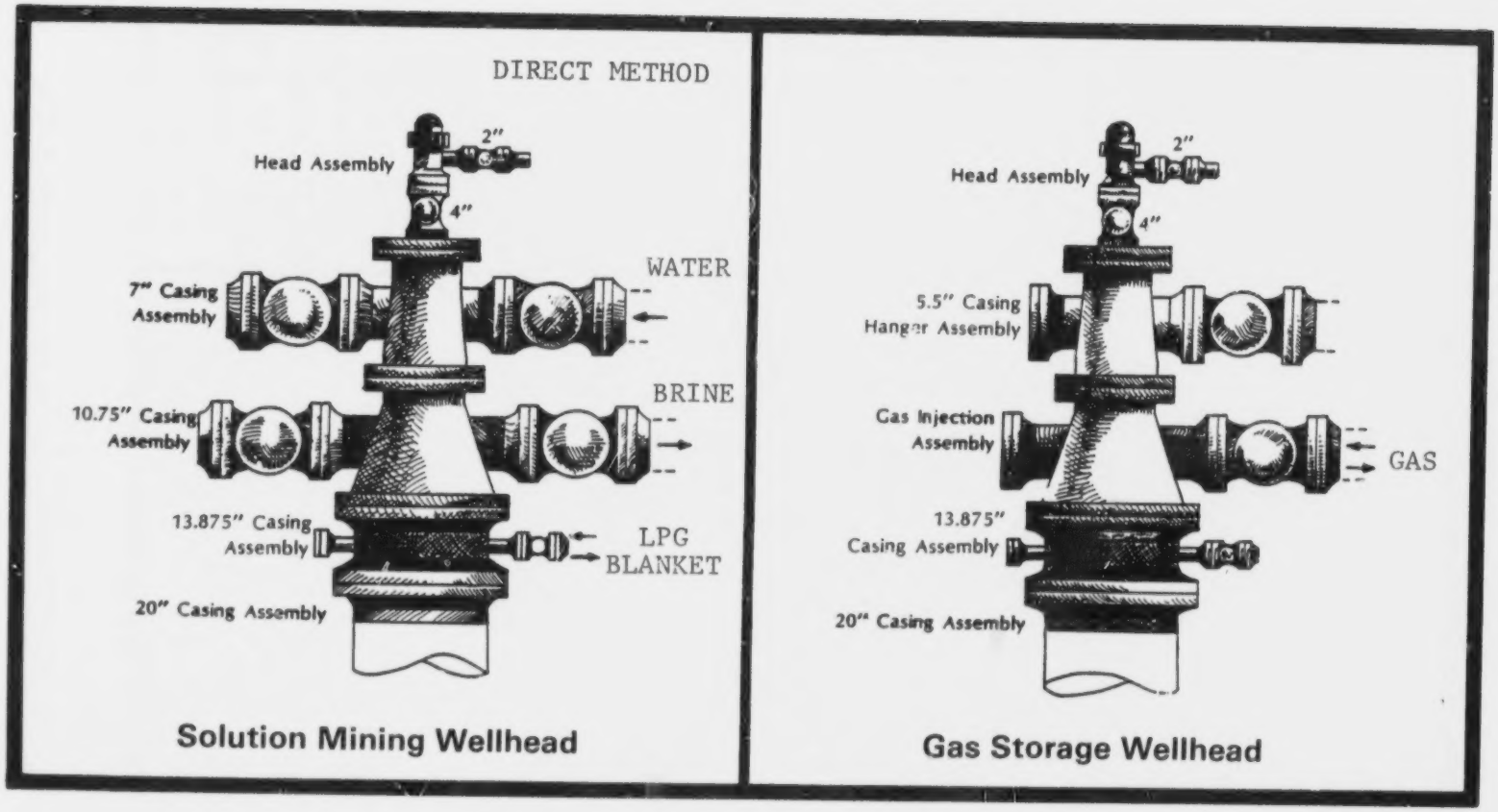


Figure 4

Wellheads to Construct and Operate Natural Gas Storage Facilities

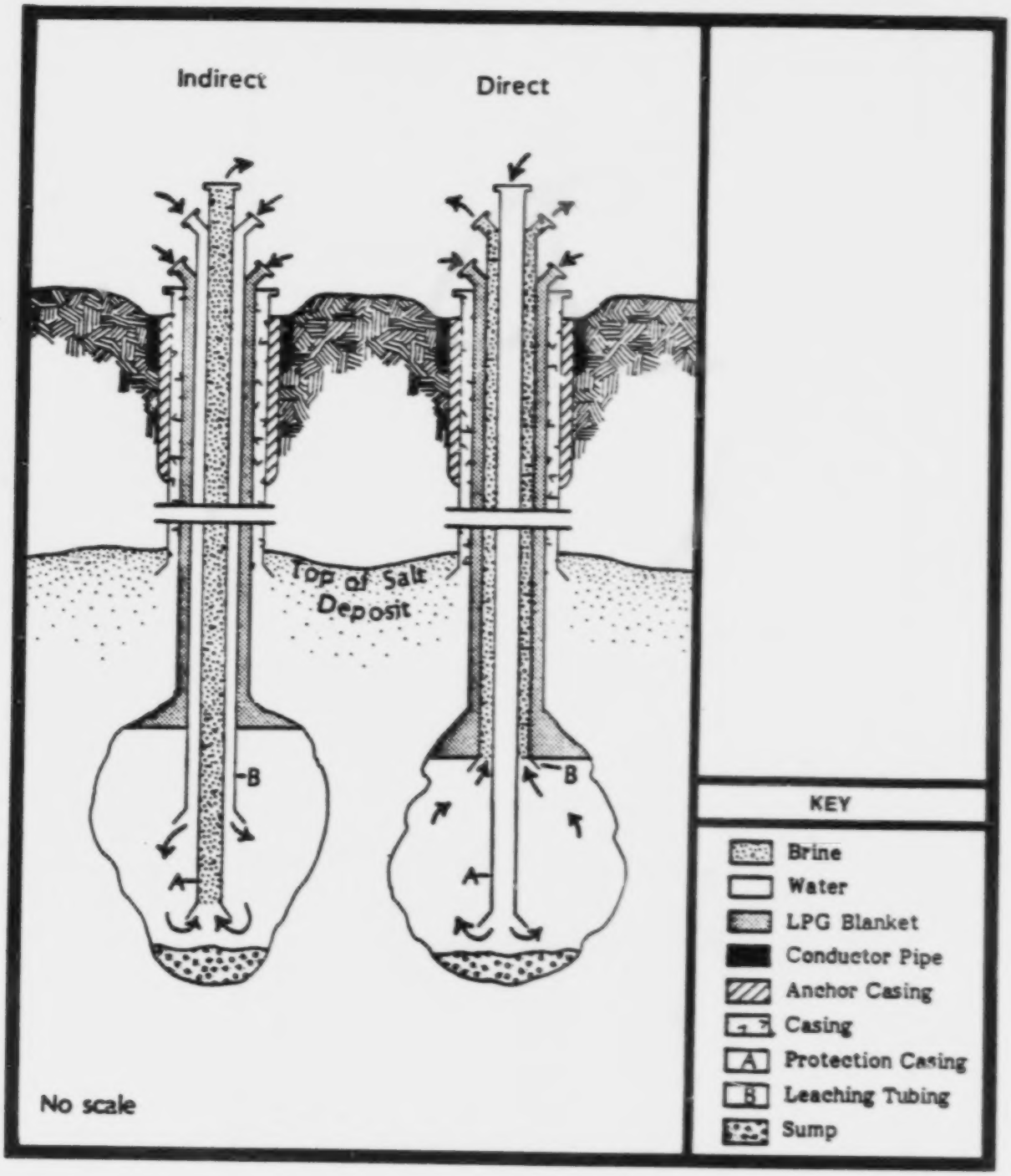
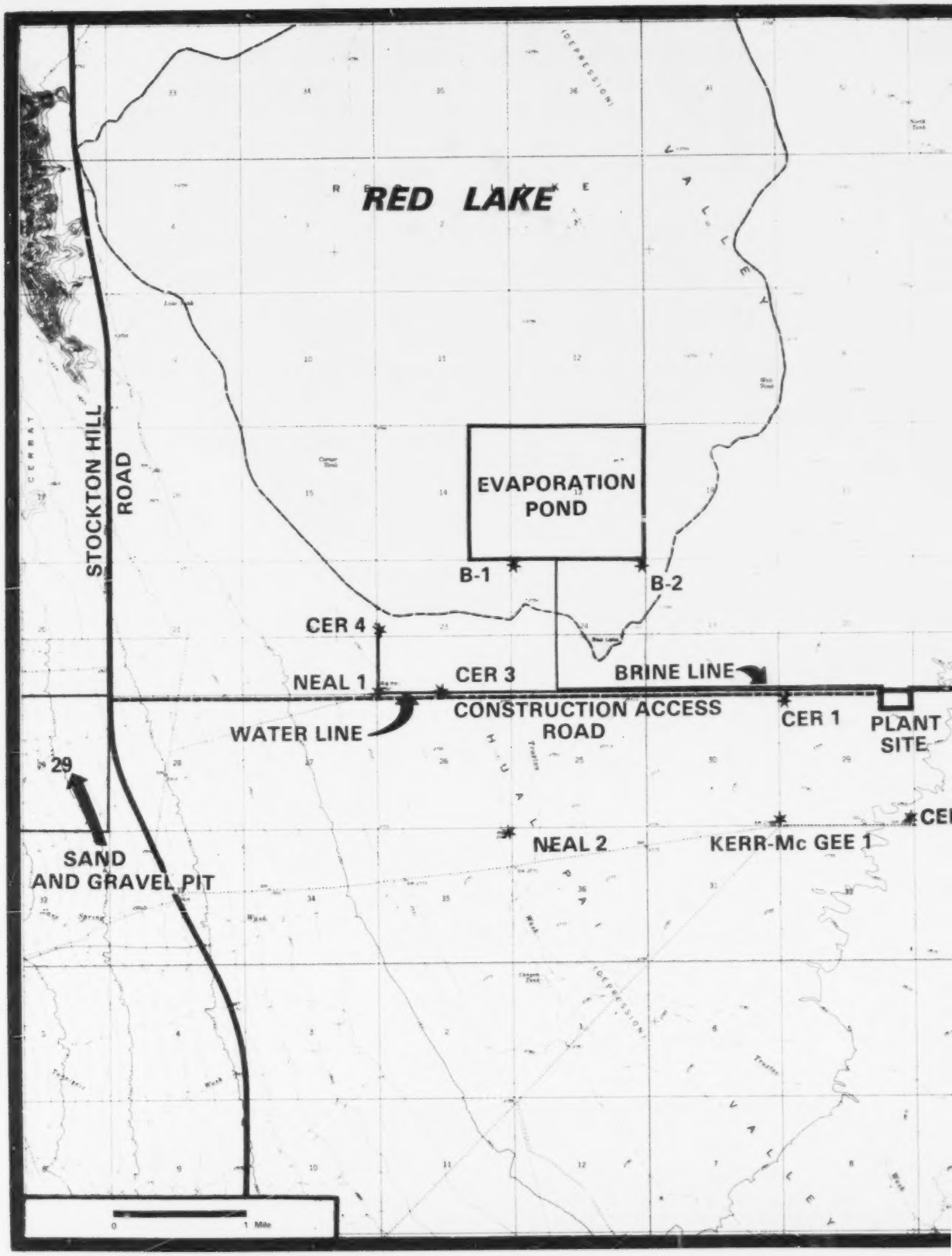
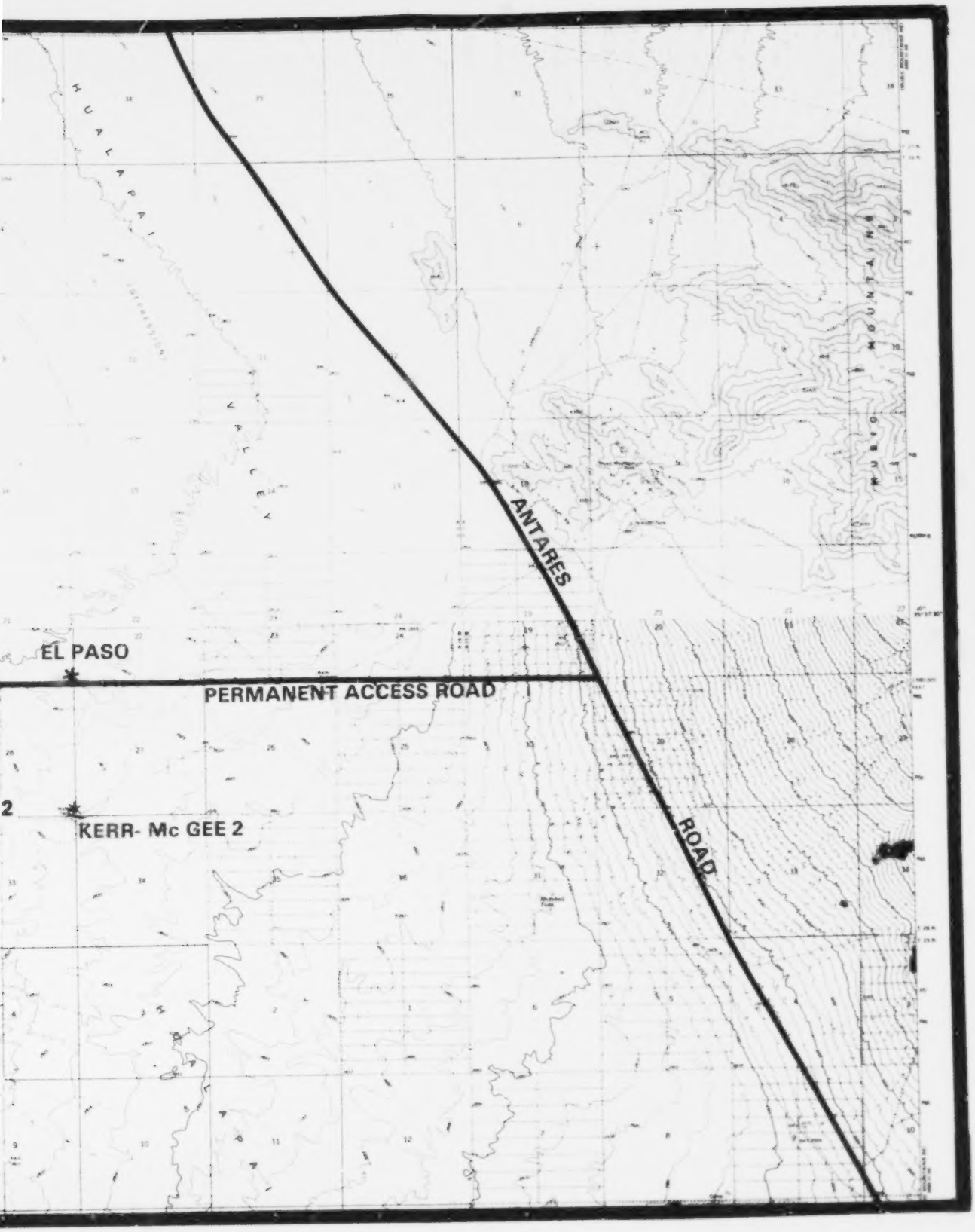


Figure 5
Direct and Indirect Cavern Leaching Methods


RED LAKE
STOCKTON HILL ROAD
EVAPORATION POND
B-1
B-2
CER 4
NEAL 1
CER 3
BRINE LINE
WATER LINE
CONSTRUCTION ACCESS ROAD
CER 1
PLANT SITE
29
SAND AND GRAVEL PIT
NEAL 2
KERR-Mc GEE 1
0
1 Mile

Pro



gure 6
ct Layout

through underground piping to the evaporation pond, shown in figure 6. Located approximately 4 miles from the actual gas storage facilities, the proposed pond system would be situated on the surface of Red Lake, a seasonally dry, hydrologic depression. Evaporation by solar insolation, ambient low humidity, and local winds would reduce the volume of the solution, yielding 1.56 million tons of salt.

The surface of the Red Lake playa consists of low permeability, silty clay material. Approximately 100,000 cubic yards of this natural material would be used to construct the 4.5-feet high perimeter and interior dikes surrounding the evaporation pond (figure 7). A thin layer of surface clay would be scraped from the playa and used as the primary construction material. A cut-off wall--a vertical subsurface compacted clay barrier--would be constructed below the perimeter dikes to minimize any shallow, lateral seepage of brine. This continuous wall around the brine pond would be a minimum of 2 feet wide and 3 feet deep, compacted to the same specifications as the dikes and pond floor, and deepened where necessary. Following compaction of the dikes and basin surfaces, rip-rap would be placed along the interior face of the dikes to protect them from wave erosion.

Following evaporation, and assuming equal distribution of the brine over the ponds, approximately 12 to 18 inches of residue would remain on the pond surface. If additional caverns were constructed, the first salt layer would be left in place to form a base for harvesting equipment. One hundred percent of the second and any later salt productions could then be recovered with minimal processing.[1/] If, after the first two caverns are completed, the applicant decides that no additional gas storage caverns are needed, the entire salt mass deposited in the ponds would be harvested down to the clay bottom, and the pond site would be restored to its original appearance.[2/]

Since the bottom 3 to 6 inches of the salt layer would be contaminated with clay and sand particles, salt washing facilities would be necessary to process it before shipment. The salt washing and stockpiling operation is shown schematically in figure 7. These facilities, adjacent to the evaporation pond, would be

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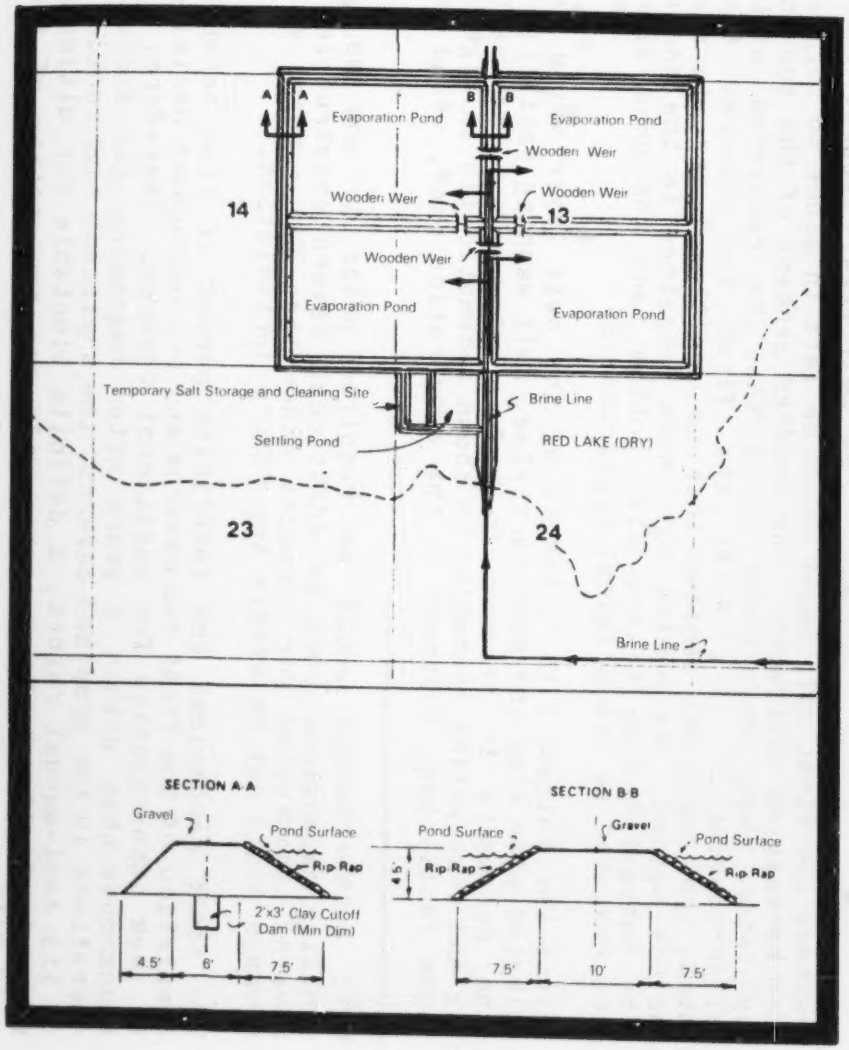
1/ FERC authorization would be required prior to any major facility expansions such as additional cavern construction. Caverns constructed for purposes other than for natural gas storage would not be within the FERC's jurisdiction.

2/ The staff recognizes the indefinite period of time between completion of the first two caverns and any subsequent decision to seek authorization for additional caverns. Therefore, it recommends that within 2 years after beginning gas storage operations in the proposed caverns, the applicant must include, in its semi-annual report, a definite timetable for ultimate removal of all of the produced salt and restoration of the pond site.



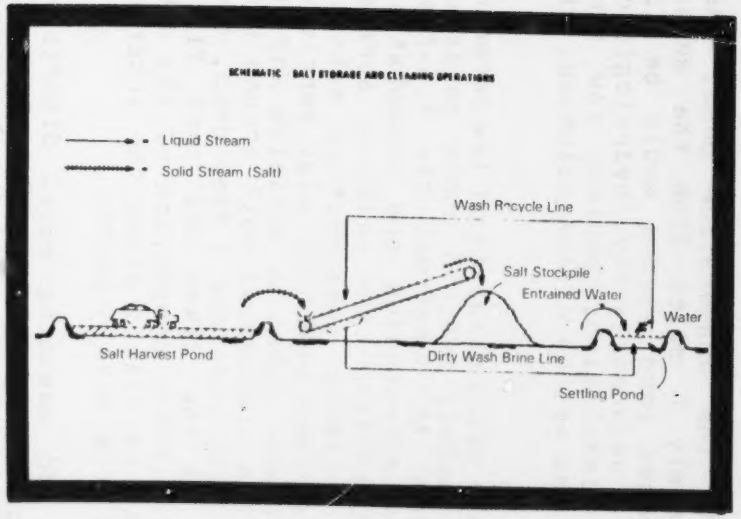


Figure 7

Proposed Evaporation Pond Design and Salt Cleaning Operation

surrounded by diking constructed to the same specifications as the evaporation pond, including the compacted floor. The operation is designed as a closed system. Fresh water would be added as needed (10 to 100 gpm) to balance evaporation losses and to keep the recycling lines from clogging. The washing flow rate would be approximately 700 gpm.

The salt would be harvested and stockpiled under moist conditions and therefore would tend to "cake-up" as it dried in the storage pile. The size of the stockpile would be limited to approximately 12,000 tons.

At the present time, the applicant does not plan to construct the salt washing facilities, nor would there be a need to stockpile the salt. The salt washing facilities would be needed only after abandonment of the evaporation pond, when the bottommost layer of soil-contaminated salt would be recovered. The current plan is to transport the clean salt by truck directly to the railroad siding at Hackberry, Arizona.

c) Natural Gas Pipeline

Concurrent with the solution mining of the storage caverns, approximately 30 miles of 16-inch diameter steel pipeline would be constructed to connect with the 24-inch, 30-inch, and 34-inch diameter parallel pipelines which constitute El Paso's San Juan mainline in the vicinity of the proposed project. This connection would be constructed at the site of an existing pipeline monitoring station about 6 miles east of Kingman.

The pipeline would traverse rural and semirural areas. In less populated areas and open country, the construction right-of-way would average about 50 feet wide and require approximately 6 acres per mile. Working space in more populated areas would be limited to about 40 feet (5 acres per mile). Typical natural gas pipeline construction requirements of 36 to 48 inches of cover, depending on the location, would be observed. When crossing other structures (e.g., pipelines and cables), a minimum clearance of 24 inches would be maintained.

The pipeline would be constructed in a single spread. The construction would proceed in the following order: clearing and grading the right-of-way, hauling and stringing the pipe sections, preparing the ditch, bending the pipe, laying and welding the pipe, applying its protective coating or wrapping, lowering it and tying it in, testing, backfilling the ditch, and cleaning, restoring, and maintaining the right-of-way.

Special construction crews would be required to install and alter fences, bore under road and railway beds, make any necessary watercourse crossings, and construct intermediate valve control stations.

The BLM has issued a right-of-way grant for the locations where the pipeline would cross Federal lands. (See appendix A.)

d) Access Road

According to the application filed with the FERC, a 5-mile long all-weather access road would accommodate construction and maintenance traffic to the storage facility site. Connecting Antares Road and the project site to the west, the 25-foot wide graded and treated surface would occupy a 100-foot wide right-of-way. A 6-mile long road connecting the plant site to Stockton Hill Road would be constructed at grade level and used during construction. Since Federal lands are involved, the applicant recently applied to the BLM for a right-of-way grant for portions of the access road. That application, currently before the BLM, calls for a 60-foot wide right-of-way with a 35-foot wide elevated gravel-fill roadway connecting Stockton Hill Road, the plant site, and Antares Road along the same route. (See figure 2.)

After surveying and staking, the access right-of-way would be graded and compacted as necessary. The roadbed would consist of native soil and imported gravel and would be maintained with a spray-applied treatment of a commercial soil stabilizer, magnesium chloride, which would be reapplied at least once a year for dust control.

Construction traffic would vary considerably from day to day. In addition to a wide variety of heavy and light construction equipment moving about the construction sites, tractor trailers and light-duty trucks would use Antares Road and Stockton Hill Road to deliver these construction vehicles, other equipment, fuel, and parts to the plant site. Construction worker traffic would be significant during the first 2 years of construction. Salt harvesting would also create substantial vehicular traffic. Although the actual number of trips has not been estimated, a nearly continuous daytime flow of traffic would occur during the 2-year construction phase of the project.

If necessary during construction, traffic control signs would be installed at the intersection of the access road and Antares Road. As an alternative, flagmen would be available to ensure the safe flow of traffic along Antares Road.

Following site construction, leaching operations, and salt harvesting, vehicular traffic would be limited to one or two cars or trucks per day.

e) Permits and Authorizations

Table 1 lists the permits and authorizations needed to complete the proposed project. The BLM, a cooperating agency in preparing this EIS, has permit authority over rights-of-way which would cross Federal lands.

In addition, right-of-way agreements, leases, or purchases would have to be negotiated with any private landowners whose property would be crossed or otherwise used for project facilities.

While the applicant does not currently have title to all of the necessary land, if a certificate is issued by the Commmission, the Natural Gas Act allows the certificate holder to exercise the right of eminent domain. If purchase, exchange, or lease cannot be negotiated with the present landowners, a hearing before the district court of the United States for the district in which the property is located or in a state court is necessary to obtain such authority. Following this process, the land can be condemned.

2. Operation and Maintenance

After the subsurface connection between the proposed 16-inch diameter pipeline and El Paso's San Juan mainline was completed and the storage caverns were ready, gas transported through the El Paso pipeline would flow through a valve assembly north to the Pataya facility. The first fill (estimated to take 90 days) would displace the final cavern volume of brine and prepare the storage system for normal operations.

At the storage facility, the gas would be metered before entering the compressor building. Three 1,800-horsepower, natural gas-fueled reciprocating engines would compress the gas received from El Paso at approximately 720 to 810 pounds per square inch actual (psia) to 1,000 to 3,000 psia. Following compression, the gas would be cooled and injected into the caverns. Because of fluctuations in ambient cavern volumes, one, two, or three compressor units would be operated simultaneously. It is estimated that the compressors would operate for 2,160 hours per year.

Gas would be withdrawn from the storage cavern by reversing the valve at the wellhead. The pressurized gas would be removed from the caverns and piped to the dehydrator, which would use a glycol-based system to remove water from the gas. About 1,700 cubic feet per hour of natural gas would be required to fuel the dehydrator.

Any entrained hydrocarbon liquids would be removed in the filter separator and stored on the plant site for subsequent sale or disposal. The gas would then be metered, depressurized, treated

TABLE 1

PERMITS AND AUTHORIZATIONS REQUIRED TO IMPLEMENT PROPOSED PROJECT

Agency		Authority
Federal	FERC	Issues certificate to construct and operate facility.
	Bureau of Land Management	Issues right-of-way grant for facilities on Federal land.
	U.S. Environmental Protection Agency	Issues prevention of significant deterioration permit, if required.
State of Arizona	Department of Health Services	Issues permit for both construction and permanent equipment; makes recommendations on figutive dust control.
	Department of Water Resources[1/]	Issues water well and potable water permits.
	Land Department	Issues rights-of-way for facilities on state lands.
	Mining Board	Issues certificate for safety training of mining personnel.
	Oil and Gas Commission	Authorizes storage cavity design and construction.
	Water Quality Board	Issues permit for ponds and solution wells.
Mohave County	Board of Supervisors	Issues conditional use permit; rezones property.
	Fire Department	Issues permit for fire protection
	Health Department	Issues septic tank permit.
	Planning and Zoning Commission	Issues building permits.
	Road Department	Issues road construction permit.

1/ Division of Dam Safety would review evaporation pond design if water level were above 6 feet.

to pipeline requirements, and injected into the proposed 16-inch diameter pipeline. Pipeline flow would be reversed, allowing the gas removed from storage to be transported south to the El Paso interconnection. El Paso would transport the gas for use by Southwest customers.

Additional structures and equipment used during the operation of the proposed facility would include site fencing and security lighting, monitoring equipment, storage tanks for liquid hydrocarbons filtered from the natural gas, and an auxiliary building for small tool storage, operating personnel, an emergency power generator, and the communications system.

Normal gas withdrawal and injection operations would be controlled by a telecommunications system from Las Vegas; only one or two employees would be stationed at the facility. A microwave link to be installed between the cavern site and the Las Vegas office of Southwest would include one relay station at Red Mountain, near Boulder City, Nevada (an existing site operated by Southwest) and another at an as yet unselected site, probably in the Cerbat Mountains to the west of the plant site. The staff recommends that this site be reviewed and approved before construction begins. Receivers and transmitters would be required at each end point and relay point. Remote control would monitor the recording instruments at the storage site, control valves to allow flow of gas into and out of the caverns, and start and stop the gas compressor engines.

Routine maintenance would include clearing and maintaining pipeline right-of-way segments; inspecting and servicing the cathodic (corrosion) protection system, and inspecting pipeline crossings of other pipelines, roads, utilities, and other construction. Periodic reconnaissance of the entire pipeline would be made either by air or by vehicle.

3. Future Plans and Abandonment

The proposed project calls for two caverns capable of storing a total of 3 Bcf of working gas. Since the initial siting and feasibility work, done before 1978, was predicated upon a need for a 10-Bcf storage capacity, there is a significant potential for expansion of the facility by solution mining additional caverns. Future caverns could probably be constructed at a lower cost than the ones presently proposed because all the necessary leaching and related equipment would remain at the site, though some piping rearrangements, additional site grading, and perhaps more compressor horsepower would be necessary. Future gas storage caverns would probably be located close to those currently proposed and arranged in some regular geometric pattern.

Of course, construction of additional solution-mined caverns would require additional groundwater withdrawals and extended use of the evaporation pond system. Furthermore, continued cavern construction implies a continued need for construction personnel and construction traffic, with associated impact.

Since the applicant has repeatedly alluded to plans for expansion of the proposed facility over an extended period of time, this EIS addresses the impacts of expansion which would occur in addition to those of the present proposal. In addition, the staff's recommendations to mitigate the impact of the current proposal (chapter 5) would develop the data necessary to more accurately and expeditiously assess the impact of expansion. Any expansion of the facility would require additional FERC certification.

It is conceivable that caverns in other areas of this unique salt deposit could be developed for other uses such as hazardous waste disposal. However, such development is not directly related to this project. Although successful completion of the Pataya project might encourage accelerated industrial development in the area, the type and extent of development and the potential environmental impact of that possibility is not reasonably predictable.

It is also possible that continued operation of the proposed gas storage system could become physically or economically impractical. In this event, the entire final volume of stored gas could be withdrawn from the caverns. The pipeline facilities would probably be emptied and filled with inert gas or corrosion inhibitors. All storage tanks at the project site would be drained and isolated. Connections would be removed and sealed by bolted flanges or plugs. Electrical circuits, as well as compressor and dehydrator units, would be disconnected. All piping would be cut and sealed below ground level. If the area occupied by structures and equipment were designated for other uses, belowground equipment other than the storage caverns would be dismantled and removed from the site. Under section 7(b) of the Natural Gas Act, FERC authorization would be required to abandon the proposed facility and the service it would render.

Salvaging the gas pipe would require construction similar to the installation of the pipeline system. Additional backfill might be required, although sections beneath roadways and railways would probably remain in place.

The proposed evaporation pond would be abandoned using the procedures discussed in section 1.b.

B. ALTERNATIVES

The general objective of the proposed project is to develop more reliable delivery to Southwest's natural gas customers during periods of high demand. To meet this objective in an economically and environmentally acceptable manner, siting and engineering criteria were established by Pataya. The requirements included: (1) sufficient storage capacity for 10 Bcf by 1985, with 2.5 to 3 Bcf available by the early 1980's; (2) deliverability of 100 million cfd; (3) proximity to a major natural gas transmission pipeline with sufficient capacity and flexibility to transport gas from storage; and (4) proximity to Southwest's market area. The environmental staff's analysis is based on the assumption that any feasible alternative must meet requirements 2, 3, and 4. The staff specified that 2.5 to 3 Bcf of storage capacity be available by the early 1980's with significant expansion capacity available, but not necessarily to 10 Bcf.

1. No Action

The actions that are available are to grant the certificate that is sought, to deny it, or to postpone action pending further study. If action were postponed, one of the other two actions would ultimately follow. The FERC is solely responsible for determining whether the Red Lake Storage Project is in the public interest; it will therefore determine the need for the project.

Denial of the project could result in no construction of the proposed system, construction of an equivalent alternative system, or increased use of alternative energy sources. If the proposal is denied and no alternative system is recommended, the conclusion would be that the proposed service is not needed or required by the public convenience and necessity. Construction of an equivalent alternative system could result in more or less environmental impact than the proposed project, depending on the nature and location of the required facilities.

The applicant states that since 1973, it has curtailed gas deliveries to its industrial and powerplant customers throughout its service areas which receive their base gas supply from El Paso. These curtailments are the result of El Paso's gas shortages during periods of high demand. Long-range gas supply forecasts prepared by El Paso indicate continued and increasing curtailments of gas deliveries to Southwest's industrial and powerplant customers.[1/] Should curtailments occur without the benefit of nearby gas storage

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1/ El Paso was updating these forecasts when this EIS went to print. Therefore, possible modifications to these forecasts because of the new information cannot be addressed here.

or increased deliverability, those low priority customers with alternate fuel capability would have to burn other fuels. Less manageable economic impact could result if customers without alternate fuel sources were curtailed. The use of the facility for supplying lower priority users is an issue in these proceedings.

Curtailments are also projected for Southwest's residential and commercial customers as early as 1987. While these customers are, by definition, high priority, the projected curtailments are pertinent to future residential community growth. Pataya states that, under the various assumptions used in the gas supply forecast study, if the Red Lake Storage Project or some appropriate alternative is not implemented, future curtailment will be inevitable. However, the need for the proposed project has not yet been established by the Commission. The No Project Alternative is therefore a possibility.

2. Brine Disposal Alternatives

a) Impermeable Liners

Using impermeable membrane liners instead of the proposed compacted playa materials would temporarily prevent the brine from seeping through the playa deposits, but the long-term effectiveness of this technique is uncertain. Furthermore, costs associated with lining the proposed evaporation ponds could significantly increase the cost of the overall project--from $8.75 million to over $22 million, depending upon the liner material chosen, its thickness, and installation costs.1/

The relative impermeability of the underlying playa material suggests that steady state seepage (i.e., no major cracks, fissures, or other anisotropies exist) would probably not be a major problem. Therefore, impermeable liners would serve no useful purpose.

1/ These figures assume a lined area of 872 acres. Low values were calculated for a 10-mil (0.01 inch) unreinforced polyvinyl chloride liner covered by 1 foot of playa material. (Covering would be necessary to protect the liner from ultraviolet degradation.) High values were calculated for a 36-mil polyester reinforced chlorosulfonated polyethylene ("Hypalon") liner. Hypalon liners are not subject to ultraviolet degradation.

b) Alternative Evaporation Pond Design

As discussed in section 2.A.1, the applicant proposes to dispose of brine generated during the solution mining process by pumping it into evaporation ponds constructed on the surface of the Red Lake playa. Evaporation would then reduce the brine to solid salt, which would be harvested for sale.

Figure 8 illustrates the applicant's original pond design. This proposal involved harvesting all but the lower 3 to 6 inches of solid salt for sale, regrading the dikes over the residual salt, and scraping an additional 200,000 to 335,000 cubic yards of soil from neighboring playa sections to build up a 3- to 6-inch cover over the salt. This proposal would have created a large surficial salt lens with a thin soil cover 6 to 12 inches above the current base level. Under the premise that a certain amount of salt would be unrecoverable, the staff recommended an alternative pond design which increased the long-term isolation of the residual salt. This alternative design, recommended in the DEIS, is also illustrated in figure 8.

Since publication of the DEIS, the applicant has modified both its original pond design and its salt harvesting plan. To resolve the question of secure long-term isolation of the residual salt, the applicant now proposes to harvest all of the salt remaining once solution mining operations have terminated. This modification provides several advantages over the applicant's original proposal and the staff's alternative:

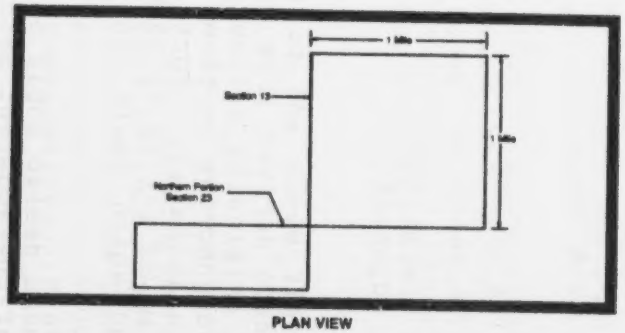
> All of the salt would be harvested, compared with only about 24 percent under the original proposal.

> Concern over secure long-term isolation of the residual salt would be avoided.

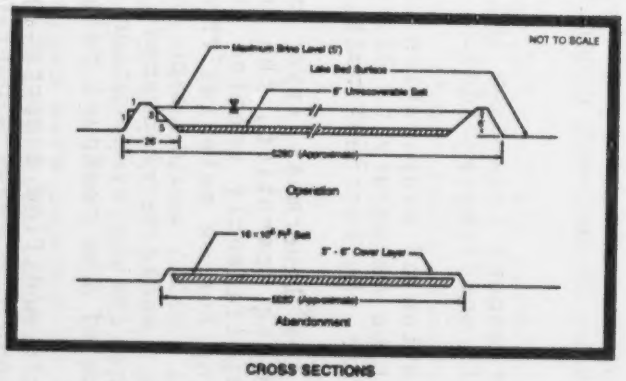
> Upon termination of evaporation pond operations, it would not be necessary to disrupt adjacent areas to cover the residual salt.

Although cleaning the lowermost layer of salt would add to the cost of the harvesting operation, the proceeds derived from salt sales should be significantly greater than originally estimated. The costs of hauling borrow material from neighboring sections to cover the residual salt would also be eliminated. Further, because all the salt would be recovered, it would not be necessary to construct a more costly evaporation pond which would provide long-term isolation of the residual salt.

The applicant's modified evaporation pond design would cover all of section 13 and the eastern portion of the adjacent section 14, as illustrated in figure 7. In addition, approximately 11 acres in the northwest corner of section 24 would be used for a

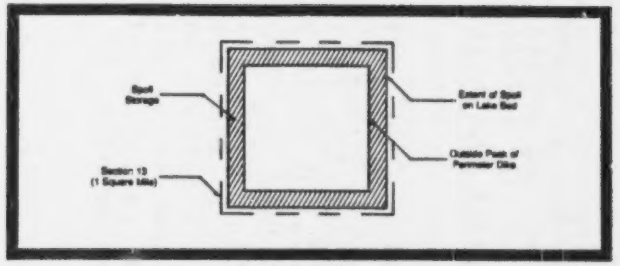


PLAN VIEW

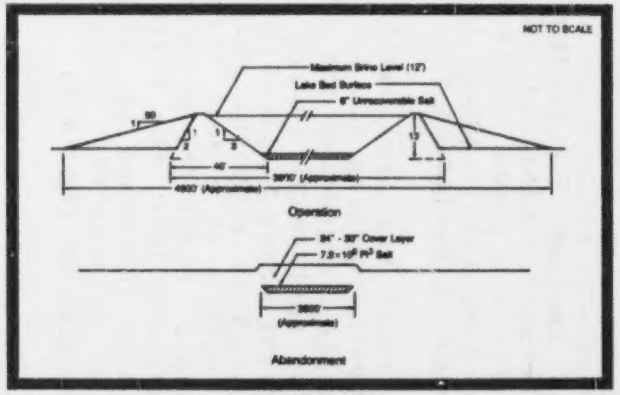


CROSS SECTIONS

Previous Design



PLAN VIEW



CROSS SECTIONS

Alternative Design

Figure 8

Rejected Evaporation Pond Designs

temporary salt storage and cleaning operation, when needed. While the revised pond design would be approximately the same size as the previous proposal, the current design avoids the potential problem of constructing on the recent large desiccation cracks in section 23. Avoiding construction in section 23 could also negate the need for the drainage diversion system originally proposed to protect the evaporation pond from floodwaters through Truxton Wash.

c) Deep Well Injection

In view of the large volume of brine which would be generated during the proposed solution mining and the potential environmental concerns associated with shallow burial of a relatively large volume of salt, the environmental staff considered deep well injection as an alternative means of brine disposal. Given the appropriate geologic and hydrogeologic conditions, brine can be injected into deep brackish or saline aquifers.

Since no deep well disposal has been done in the project vicinity, it is not known whether a suitable injection zone is present. To ascertain the feasibility of this disposal option, at least one exploratory well would be required. Once a possible injection zone was identified, aquifer tests would have to be performed to determine the various aquifer parameters (lithology, porosity, permeability, thickness, etc.) and to assess the capability of the injection zone to accept the brine at the anticipated rate of flow (3,000 gpm, a relatively high rate). A comprehensive feasibility evaluation and development of a disposal well could cost several million dollars, depending upon the extent of current subsurface knowledge and the depth(s) at which suitable disposal zones were found. Costs associated with drilling, testing, and completion of a deep well alone could exceed a million dollars.

Because the brine generated during solution mining would be composed primarily of sodium chloride (i.e., table salt), introducing it into a stratum already saturated with saline water would present certain environmental advantages over the currently proposed disposal method. The composition of the byproduct brine also suggests that chemical compatability with a saline groundwater would not be a problem. Further, recent seismic surveys (figure 19) in the Red Lake area indicate that a number of sedimentary strata underlie the valley between the base of the salt deposit and the Precambrian basement bedrock. Therefore, a suitable injection zone might be present. In the absence of specific knowledge to the contrary, such factors may be interpreted optimistically. Nevertheless, only a deep exploratory drilling and aquifer testing program would provide the data necessary to evaluate this alternative. Since the environmental staff believes that the proposed pond design would be feasible, it does not appear that the expense of drilling the necessary exploratory well would be justified.

Therefore, further analysis of this alternative is not practical. However, if the proposed pond site becomes unsuitable, the deep injection alternative would remain an option warranting further study.

d) Induced Salt Evaporation

Salt can be produced from brine by boiling off the water. The vacuum-pan multiple-effect system is the most common method of producing salt from brine solutions. The first multiple-effect salt evaporation plant was constructed in 1899. Since then, numerous process support changes have improved the overall plant operation. The construction and operation of a vacuum-pan multiple-effect salt recovery plant at the Red Lake site would eliminate the need for the proposed evaporation ponds. The process feed would be the brine solution resulting from solution mining.

The plant would consist of four evaporators or "effects." Other equipment would include a process stream boiler, brine slurry storage tanks, separation equipment, product dryers, scaling equipment, and packaging equipment. About 50 acres of land would be required for such a plant and support facilities.

The major operational expense of the plant would be fuel. Natural gas or coal could be used to fuel the process boiler(s). However, the Fuel Use Act of 1979 restricts the use of natural gas to new facilities that have a heat input of less than or equal to 10 million British Thermal Units (Btu's) per hour. Since the plant would require a heat input of roughly 420 million Btu's per hour, it would be required to burn coal. A heat input rate of 420 million Btu's per hour is equal to the combustion of 21 tons per hour of coal or 420 thousand cubic feet of natural gas per hour (equivalent to 214,704 tons of coal or 4.3 billion cubic feet of gas over 14 months). A 70-kilowatt electric generating plant would have a similar fuel consumption.

The estimated base price of constructing an "off the shelf" multiple-effect evaporating plant would be about $33,780,000.1/ Additional plant support facilities such as a 30-mile long railroad spur would be required to transport the coal that would be required to fuel the plant's boilers. Trucking the coal to the site might be feasible but not economically practical: the current average

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1/ Assuming 10 percent inflation over 1980 dollars for plant equipment and construction.

cost of railroad construction is $1 million per mile.[1] Furthermore, the basic plant cost does not include the cost of coal handling equipment or air pollution control equipment, which could escalate the plant's cost.

If coal were used to generate steam, the fuel costs for 14 months would be $6,441,120 (not including transportation). If natural gas were used, the fuel would cost about $18,250,000. Salt production for 14 months from this plant would total 1.53 million tons (assuming an average 22-percent solute concentration). Vacuum pan-produced salt is currently sold for $77.80 per ton.[2] At this price, the salt would produce a total income of $119 million. However, it is unlikely that a salt buyer could be found in the project vicinity to purchase the vacuum pan salt at $77.80 per ton when solar salt is available for $27 per ton. If the salt were sold at this lower price, it would generate $42 million. Such an amount might return the capital investment of the plant but produce no profit.

Therefore, this alternative would not be feasible. In addition, obtaining the total volume of salt produced from the caverns within the 14 months of solution mining would require specially designed evaporators and process equipment, further limiting the feasibility of this alternative.

e) Solar Pond

The energy from the sun falling on the surface of the earth in 1 month is about equal to the entire fossil fuel reserves of the world. Until recently, the silicon solar cell has been the most efficient way of generating electricity directly from sunshine. However, this type of electrical generation is very costly and requires large land areas for numerous solar collectors. Another disadvantage is that the solar collectors are actually degraded by sunlight, requiring constant maintenance and repair.

A solar pond, which has a yearly collection efficiency of 25 percent, is a static body of water that collects solar energy and stores it as thermal energy. This thermal energy can be used for a variety of purposes, including electrical power generation and industrial process heating. The basic principle of solar ponds is to prevent the flow of heat from the bottom of the pond to the top.

1/ Tom Wofford, Federal Railroad Administration, telephone conversation with Commission staff, April 16, 1982.

2/ D. S. Kostick, U.S. Department of the Interior, Bureau of Mines, telephone conversation with Commission staff, April 15, 1982.

In a normal body of water, the sun heats the water during the day; the heat is lost to the surrounding environment at night. A salt gradient prevents the hot, denser water of the lower region from rising.

Wind and localized surface heating creates a homogeneous layer of saltwater in the top 12 inches of a solar pond. Immediately below this layer, a salt gradient forms. (Concentration increases with depth.) The lower layer, or storage zone, has a relatively constant salt concentration, typically from 15 to 20 weight percent sodium chloride. Other salts may be used, but sodium chloride is the least expensive.

Convection (heat loss) occcurs only in the top and bottom layers. The salt gradient prevents normal convection from carrying the hot water from the bottom to the surface. Solar radiation heats the water at the bottom to a much higher temperature than the surface. The average water temperature at the bottom of these ponds can range from 194`F to 210`F. The stored heat, removed by a heat exchanger, can be routed to a powerplant to generate electricity.

However, solar ponds are still experimental. Two types of engineering problems remain to be solved. First, how much heat can be collected, and how can this heat be extracted from the bottom of the pond? Second, can stability be maintained to prevent mixing of the layers? In addition, there are numerous technical problems, such as how to construct the pond container, how to establish and maintain the salt gradient, how to keep the pond clean and transparent, and what to do with the heat generated.

Development of this alternative would defer abandonment of the evaporation pond and add to the experimental data base of a new technology. Since implementation of this option would not significantly alter the environmental impact of the proposed storage project and there are concerns about its technology and reliability, it was not given further consideration.

f) Salt Marsh Pond

The Arizona Game and Fish Department has suggested that the evaporation ponds could be managed to provide habitat for migrating waterfowl. The management plan would include introducing salt-tolerant vegetation, algae, brine shrimp, and brine fly larvae to the ponds and maintaining adequate water levels by pumping the alkaline groundwater under the surface facilities. The environmental staff believes that the potential benefits of such a management program would not justify the necessary expense. The high evaporation rate would necessitate that approximately 350 to 800 million gallons of water per year be pumped to replenish the pond.

The extent of alkaline groundwater is currently unknown. Furthermore, the staff believes that removal of all of the salt upon abandonment of the pond site and restoration of the area is the preferred alternative.

3. Alternative Sites

a) Alternative Storage Sites

CER Corporation, consultant to Pataya, investigated the possibility of solution mining a storage cavern in the Luke salt body near Phoenix. The Luke salt body is the only other possible salt cavern storage site near the Southwest system known to the staff. The possible site, near a major El Paso pipeline, would require only about 2 miles of pipeline to connect to the storage facility, instead of the 30 miles required by the proposed project. There is little doubt that the salt body would be able to contain the caverns; in fact, LPG is stored in a number of leached out caverns in that area.

However, it is not certain that sufficient volumes of water could be obtained for the leaching process. The Luke site is near the Phoenix metropolitan area, and groundwater needs there already far exceed the annual recharge into the groundwater system. The feasibility and availability of sufficient acreage for evaporation ponds is also in question, since subdivision development in the Glendale area is encroaching on the potential facility location. Furthermore, there are no suitable low permeability soils in the area, so evaporation ponds might have to be lined--a substantial additional expense. In view of these disadvantages of the Luke site, the cost of constructing the required facility in this location would probably be far higher than a similar sized facility at Red Lake and was therefore not given further consideration as an alternative.

b) Alternative Rights-of-Way

The proposed pipeline route would traverse Hualapai Valley in a north-south direction. The terrain slopes gently toward the Red Lake area; no unusual construction conditions are anticipated, and no critically sensitive wildlife habitat would be crossed. While minor deviations from the route indicated in figure 2 might occur, there are no significantly superior alternatives.

The initial proposal included approximately 26 miles of 69-kV powerline that would parallel the proposed pipeline. This portion of the project has since been modified. Current planning is to install onsite power generating equipment. There are two existing electric powerlines in the vicinity of the proposed plant site.

However, both are major transmission lines (i.e., greater than 340 kV) and do not supply power to individual customers. Supply to the site from a 20.8-kV line which presently terminates in the Dolan Springs area northwest of the site was considered, but that line would be too small for the proposed power requirements.

Onsite power generation would eliminate the impact of constructing 26 miles of powerline, but it would also increase air emissions because of the fossil fuel-driven generator engines.

Two well-developed roads traverse Hualapai Valley. Both are unpaved, hard surface roads maintained by Mohave County. Stockton Hill Road runs from Kingman along the west side of the valley, northward past the Red Lake area. Antares Road, traverses the east side of the valley. (Both roads are shown on figure 2.) Either road could provide access to the site if 5 to 6 miles of additional roadway were constructed.

Use of Stockton Hill Road for access to the proposed plant site would require crossing the floodplain of Truxton Wash. Since flooding does occur, though infrequently, an access road connecting to Stockton Hill Road might be unusable at times. Though access via Stockton Hill Road was originally proposed, the permanent access road is currently planned to approach the site from Antares Road to the east. This route would cross high ground and would not enter the floodplain. The access route from Stockton Hill Road would be graded as a construction road and would be subject to periodic inundation. Therefore, the Stockton Hill Road approach would not be as suitable as a road from Antares Road for permanent site access.

John and Evalee Neal, landowners in the area, have suggested an alternative route for the permanent site access road from Antares Road. (See appendix G, letter of comment from Keith F. Quail.) The alternative would go north from the plant site 4 miles, then east 2.5 miles to Antares Road. Since this alternative would increase the distance (from Kingman) to the plant site by approximately 5 miles, the staff does not support it.

Since Federal lands are involved, the applicant has recently requested a right-of-way grant from the BLM. That application proposes a 60-foot wide right-of-way with a 35-foot wide elevated gravel fill roadway connecting Stockton Hill Road, the plant site, and Antares Road along the route identified in figure 6. In response to the BLM's notice of the application, John Neal has proposed a revised alternative route for the permanent access road to the east of the plant site. This alternative would follow the applicant's proposed route for 1 mile to the east of the plant site, cut northeast diagonally across section 22, then due east to Antares Road. While this route would increase the distance (from Kingman) to the plant site by approximately 1 mile, the amount of roadway the applicant would construct would remain the

same. The alternative would also avoid the Neals' corrals and watering facilities in the southeast corner of section 23. The FERC environmental staff has no objection to this alternative.

4. Project Alternatives

It is conceivable that the applicant's gas requirements can be met without constructing the proposed salt caverns. Four alternative approaches are: construction of an LNG plant, development of a conventional underground storage or pore space reservoir, use of storage space at existing or readily expandable gas storage fields, or firm delivery of an increased volume of wellhead gas or El Paso base supply. Any of these alternative projects would preclude the need to construct the proposed storage caverns if a system that meets the siting and engineering criteria for the Red Lake Storage Project could be designed.

In the first alternative, natural gas could be liquefied by removing heat, thereby reducing its volume to approximately one six-hundredth of that at standard temperature and pressure. The resulting LNG, maintained at a temperature of approximately -260°F, is usually stored in heavily insulated aboveground cryogenic storage tanks (commonly 9-percent nickel steel). Applying this process to meet the proposed project's basic objectives would require construction of liquefaction and vaporization systems and perhaps two or three LNG storage tanks.

In general, the facilities required for storing LNG equivalent to 3 Bcf of natural gas would probably require an investment of construction and operating funds significantly greater than that of the proposed cavern storage system. The additional seismic risk studies and other analyses required by U.S. Department of Transportation (DOT) regulations, the detailed planning and other engineering studies, and the lead time necessary to fabricate the cryogenic hardware would probably add considerable cost and delay to the project. There is no environmental, economic, or safety advantage to LNG other than lower water requirements; therefore, this alternative was not considered in detail.

In the second alternative--conventional underground storage--the gas would be stored in interconnected pore spaces between grains or within the fractured or otherwise porous and permeable sedimentary rock formations. This would require adequate structural or stratigraphic closure and, in some cases, a large number of wells or a relatively large volume of "cushion" gas to maintain sufficient delivery pressure.

CER Corporation has evaluated a number of potential pore space storage reservoirs in southern Nevada, Utah, and New Mexico: the

McElmo Mesa Oil Field (southeastern Utah), the Lime Ridge Raplee Anticline (southeastern Utah), the Arden Dome (Clark County, Nevada), and the Torrivio Anticline (McKinley County, New Mexico).[1/]

Of the four primary pore space prospects, two--the Lime Ridge Raplee Anticline and the Arden Dome--proved to be of only marginal interest, primarily because of the lack of geological and reservoir engineering data. Additional mapping and exploratory drilling and testing would be necessary to determine the feasibility of these sites. The two remaining prospects--the McElmo Mesa and Torrivio Anticline--have development potential; however, the McElmo Mesa is considered too small (2.8 Bcf maximum working gas) and the Torrivio Anticline too expensive (approximately 19.1 Bcf of cushion gas required for 10.5 Bcf of working gas).

The third alternative would use storage space at existing or readily expandable gas storage fields. Whether such an alternative could be designed depends on the availability of storage space, proximity of the field to a transportation pipeline with suitable capacity and interconnections, additional facilities required, and costs of the service.

The Commission staff has considered the use of storage space at existing storage fields such as the Clay Basin field (Daggett County, Utah), Washington Ranch field (Eddy County, New Mexico, and Culberson County, Texas), Barker Dome (San Juan County, New Mexico, and La Plata County, Colorado), Rhodes field (Lea County, New Mexico), and Bammel field (Harris County, Texas). All of these were eliminated from further consideration. In addition, the staff understands that all presently available capacity in Clay Basin will be used if the Northwest Pipeline - Texas Eastern project, as proposed in Docket Nos. CP82-174 and CP82-176, receives Commission approval. Washington Ranch, which is being developed according to an established development schedule, is currently fully utilized for high priority uses. Barker Dome is also fully utilized. Rhodes field is fully used, and expansion is currently impossible because of leakage problems. The Bammel field is an intrastate facility operated by Houston Pipeline Company. Southwest has been informed by Houston Pipeline Company that no capacity is available.

Firm delivery of wellhead gas is the fourth alternative to the Red Lake project. El Paso may have the mainline transportation capacity, but Southwest does not have the necessary production capability.

Because of the information developed by the Commission staff, the preliminary determination of the EIS is that there is no feasible project alternative which would meet the criteria identified and offer the service provided by the proposed project.

1/ "Review of Various Potential Gas Storage Systems," Las Vegas, February 1980.

Extensive analyses of gas supply, projected market requirements, and costs are necessary for a comprehensive evaluation of these alternatives. As noted in chapter 1 and the discussion of the No Action Alternative, results of these analyses will be an integral part of the complete record upon which the Commission will base its decision on the need for the proposed project. If the proposed project is denied and an alternative is recommended, the alternative project would be subject to further environmental review when Pataya applied to the Commission for authorization of that project. These analyses are beyond the scope of this EIS; if required, they would be the subject of future environmental studies.

CHAPTER THREE
AFFECTED ENVIRONMENT

A. CLIMATE

Monthly precipitation at Kingman, Arizona, is shown on figure 9.[1/] Almost half of the yearly precipitation comes from Pacific storms that enter the continent along southern California from December through March. A brief peak of rainfall occurs in August, the result of warm, moist air from the Gulf of Mexico rising over mountain peaks, cooling and forming thunderstorms. Because the ground is extremely dry in August and the intensity of rainfall is high, rainfall runs off, eroding streambeds and flooding playas. (As much as a half-inch of rain can fall in less than 15 minutes.) The Red Lake playa is most likely to flood during this period, but flooding can also occur in the winter. Floodwaters are rarely deeper than 6 inches. Precipitation averages 10.63 inches yearly, but it can vary widely from year to year. The greatest difference year-to-year occurred in 1941 and 1942, which had 16.5 and 5 inches of precipitation, respectively. The highest yearly precipitation on record is 20 inches (1919); the lowest is 3.5 inches (1947).

The nearest weather station that records wind data is north of Las Vegas at the Nellis Air Force Base, approximately 70 miles northwest of Red Lake. Because there are several mountains and valleys between Las Vegas and Red Lake, wind at the two locations is somewhat different. A recent study of the project area estimates the following facts about the wind in Hualapai Valley.[2/]

> Spring winds are strongest; dust storms are common (no prevailing direction estimated).

> Summer winds are southerly, 8-12 miles per hour.

> Winter winds are northerly, 12-24 miles per hour.

1/ Kingman, located 28 miles south of Red Lake, is the nearest weather station to the site. Lying about 600 feet higher than Red Lake and saddled between two mountains, Kingman probably receives a little more precipitation and is a little cooler than Red Lake.

2/ BLM, Proposed Livestock Grazing Program: Cerbat/Black Mountain Planning Unit; Final Environmental Impact Statement (Phoenix, 1978), p. II-4.

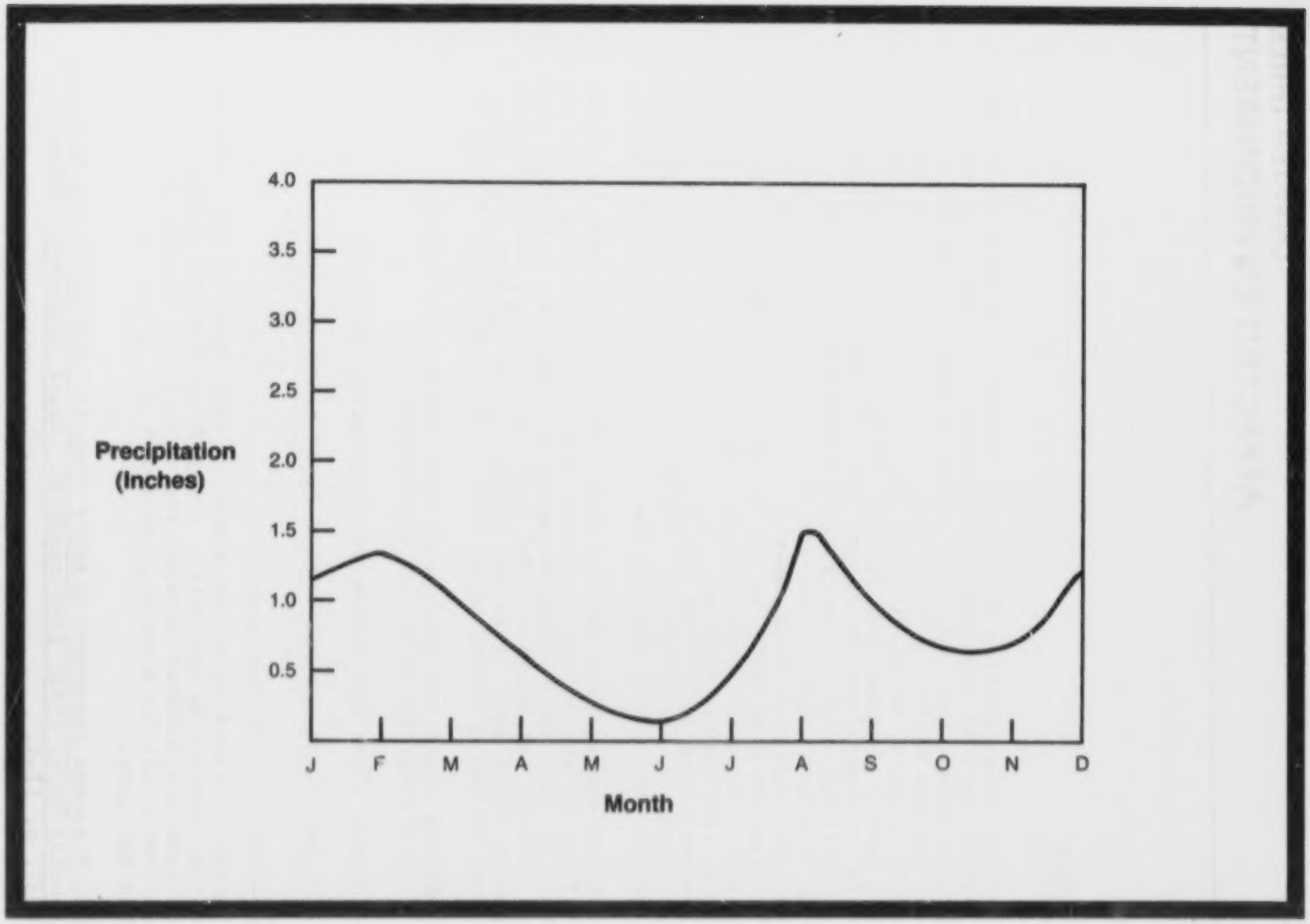

Figure 9
Mean Monthly Precipitation: Kingman, Arizona

- Night winds are very light; morning winds are moderate and oriented north and south; afternoon winds are stronger with changeable directions.

- Winds blow about 70 percent of the time; the most extended periods of calm occur during winter.

Thermal inversions probably occur at Red Lake, but because of the lack of data, the frequency, intensity, duration, and altitude of these inversions is not well known. However, it is possible to estimate some of the characteristics of these inversions based on the climate and terrain. One climatic factor is the 25° to 30° difference between the night and day surface air temperature, shown in figure 10. As the surface air temperature drops at night, it becomes cooler than the air above, forming a thermal inversion. This wide temperature variation occurs throughout the year, and inversions probably occur 3 days out of 4. Another factor is that Red Lake lies at the bottom of a basin. Cool night air drains onto the playa, bolstering the inversion layer, which may extend 300 to 1,000 feet above the surface. The night winds are normally too light to mix the thermal layers; thus, inversions persist until either the morning sun warms the surface enough to cause the air to rise or until afternoon winds dissipate it. Inversions therefore last 12 to 15 hours, but they may last several days during the winter when periods of calm are frequent. The average annual freshwater lake evaporation rate at Red Lake is estimated to be about 74 inches per year.

B. AIR QUALITY

In assessing the significance of the potential air quality impact on the proposed project, the baseline air quality levels must be compared to the national ambient air quality standards (NAAQS) which govern the United States as an outgrowth of the Clean Air Act Amendments of 1970. The national primary and secondary standards for air pollutants are presented in table 2. The primary standards are the levels necessary to protect public health; secondary standards, generally more stringent than primary standards, are designed to protect public welfare from any known or anticipated effect of all criteria pollutants. The ambient air quality standards for Arizona are also included in table 2.

The proposed facilities would be in the Yuma Interstate Air Quality Control Region, which includes Mohave and Yuma Counties, Arizona. The ambient air quality in the vicinity of the project site is quite good, largely typical of the sparsely populated nonindustrial areas of the Southwest.

According to the U.S. Environmental Protection Agency (EPA), Mohave County is in attainment for all criteria pollutants. A portion of adjacent Coconino County, was designated by the EPA on July 7, 1981, as exceeding the primary standards for total

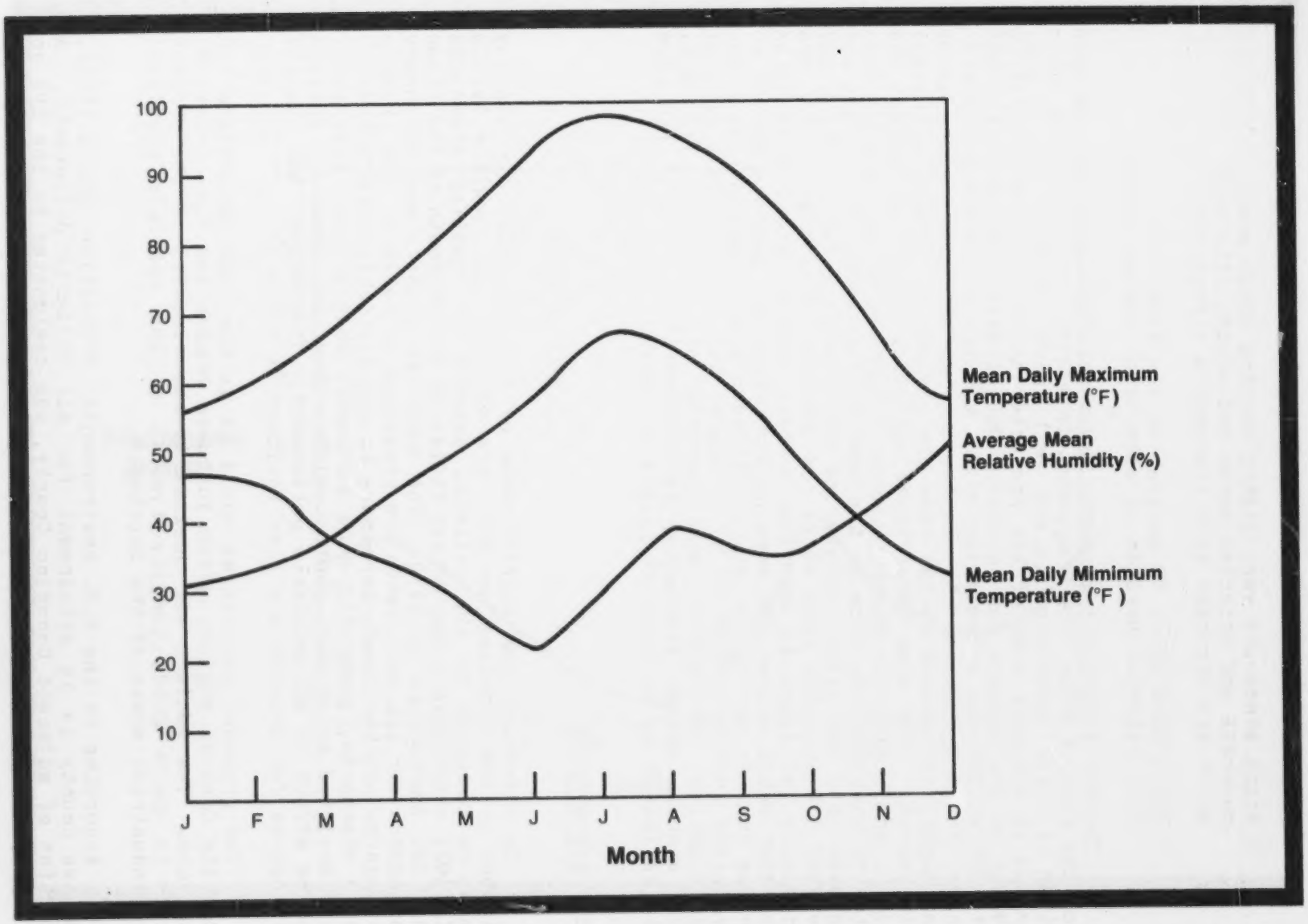

Figure 10
Temperature and Humidity: Kingman, Arizona

TABLE 2

NATIONAL AND ARIZONA AIR QUALITY STANDARDS

Pollutant	Averaging Time	Primary National Standard	Secondary National Standard	Arizona Standards[b]
Total Suspended Particulates	Annual (Geometric Mean)	75 $\mu g/m^3$[c]	60 $\mu g/m^3$	75 $\mu g/m^3$
	24-Hours	260 $\mu g/m^3$	150 $\mu g/m^3$	150 $\mu g/m^3$
Sulfur Dioxide	Annual (Arithmetic Mean)	80 $\mu g/m^3$	[d]	80 $\mu g/m^3$
	24-Hours	365 $\mu g/m^3$	[d]	365 $\mu g/m^3$
	3 Hours	[d]	1,300 $\mu g/m^3$	1,300 $\mu g/m^3$
Nitrogen Dioxide	Annual (Arithmetic Mean)	100 $\mu g/m^3$	100 $\mu g/m^3$	100 $\mu g/m^3$
Carbon Monoxide	8 Hours	10 mg/m^3[e]	10 mg/m^3	10 mg/m^3
	1 Hour	40 mg/m^3	40 mg/m^3	40 mg/m^3
Nonmethane Hydrocarbons	3 Hours (6-9 a.m.)	160 $\mu g/m^3$	160 $\mu g/m^3$	160 $\mu g/m^3$
Ozone	1 Hour	243 $\mu g/m^3$	243 $\mu g/m^3$	160 $\mu g/m^3$
Particulate Lead	Calendar Quarter Average	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$

a/ All national standards except those based on annual or geometric means are not to be exceeded more than once a year.

b/ Source: Arizona Department of Health Services, 1979.

c/ $\mu g/m^3$--micrograms per cubic meter.

d/ No standard exists.

e/ mg/m^3--milligrams per cubic meter or $\mu g/m^3 \times 1{,}000 = mg/m^3$.

suspended particulates (TSP) and sulfur dioxide (SO_2).[1/] All other criteria pollutants within Coconino County are in attainment. Periodic high particulate levels are the primary air quality problem in the vicinity of the project area, rather than high levels of the other criteria pollutants such as SO_2 and nitrogen oxides generated from stationary point sources. Ambient air quality data for TSP, SO_2, and nitrogen dioxide (NO_2) can be found in tables 3, 4, and 5.

Existing sources of particulate emissions in northwestern Arizona are, in order of decreasing importance, desert dust, unpaved roads, mining operations, power generating stations, and livestock corrals. Blowing dust on desert valley floors is quite common in dry summer months and in windy spring months. Dust particulate concentrations in the project area are generally greatest in late spring and early summer, when the ground has simultaneously lost moisture from the winter rains and is exposed to high spring winds.

Background dust particulate levels--naturally produced levels of particulates (suspended desert dust)--are a moot point because a substantial portion of the blowing dust is the result of widespread overgrazing by cattle in areas of thin soil and sparse vegetation. The topsoil gradually blows away so that the richer natural vegetation cannot grow. Cattle hoofs break the hard surface of the exposed clayey soils, allowing desert winds and updrafts to blow the fine particulates. Cattle grazing and artificially generated particulate dust is probably responsible for half the dust levels in rural northwest Arizona.

A similar source of blowing dust/particulates in ranching areas is the network of unpaved roads, which eventually develop hard, windproof surfaces covered with pebbles and large sand grains. Blowing dust then occurs only when vehicles pass over the road and break the road surface, exposing the fresh fine dust to the wind. The average daily traffic on the ranch roads in northwestern Arizona is very low--around 10 vehicles per day--but this level of disruption is enough to keep the clay dust continually exposed. Traffic on the unpaved ranch roads in Mohave County results in suspended particulate emissions of about 100,000 tons per year.

Other artificial particulate sources are the mining, construction, and mineral industries. The largest stationary sources of particulate emissions in the project area are the Duval Corporation mine at Chloride, emitting 87 tons of particulates per year, and the Lake Havasu Materials Industry, emitting 36 tons of particulates per year. These emissions do not cause regional problems

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1/ Source: "Counties Not Meeting the National Ambient Air Quality Standards (NAAQS)."

TABLE 3

1979 PARTICULATE SUMMARY FOR MOHAVE COUNTY, ARIZONA

Nearest Town	Monitoring Site	Number of Samples	Annual Geometric Mean ($\mu g/m^3$)	Maximum 24-hour Concentration ($\mu g/m3$)		Violations of of 24-hour Standards	
				Maximum	2nd Highest	Primary	Secondary
Bullhead City	224 Main Street	55	75	374	224	1	2
Davis Dam	DRI Mountain	51	23	92	63	0	0
Grand Canyon Village	Grand Canyon	25	20[a/]	119	118	0	0
Hopi Point	Grand Canyon	22	22[a/]	24	23	0	0
Katherine Landing	Davis Dam	58	25	95	86	0	0
Kingman	305 Beale Street	33	83[b/]	456	287	2	6
Lake Havasu City	Community Hospital	54	7[b/]	69	68	0	0
Nelson	Peach Springs	27	12	165	114	0	1
Riveria	Camera Site	60	35	178	122	0	1
Riveria	Hancock	57	46	289	144	1	1
Riveria	Fort Mohave	55	41	191	113	0	1

Source: Arizona Department of Health Services, 1979 Air Quality Data for Arizona (December 1980).

a/ Annual value; samples were limited by relocation or later installation of the monitoring site.

b/ Annual value based on a limited number of values.

TABLE 4

1979 SULFUR DIOXIDE SUMMARY FOR MOHAVE COUNTY, ARIZONA

Nearest Town	Monitoring Site	Number of Samples		Annual Arithmetic Mean ($\mu g/m^3$)	Maximum Average Concentrations ($\mu g/m^3$)		Recorded Violations of NAAQS	
		1-Hour	24-Hour		3-Hour	24-Hour	3-Hour	24-Hour
Bullhead City	Bullhead City	7,195	--	23	173	103	0	0
Davis Dam	DRI Mountain	7,426	--	28	124	33	0	0
Grand Canyon Village	Grand Canyon	--	20	5[a/]	--	14	0	0
Hopi Point	Grand Canyon	--	18	5[b/]	--	18	0	0
Katherine's Landing	Davis Dam	7,337	--	28	171	46	0	0
Riveria	Fort Mohave	7,304	--	28	126	38	0	0

Source: Arizona Department of Health Services, 1979 Air Quality Data for Arizona (December 1980).

-- No data available.

a/ Annual value; samples limited by termination of the monitoring site.

b/ Annual value; samples limited by relocation or later installation of the monitoring site.

TABLE 5

1979 NITROGEN DIOXIDE SUMMARY FOR MOHAVE COUNTY, ARIZONA

Nearest Town	Monitoring Site	Number of Samples		Annual Arithmetic Mean ($\mu g/m^3$)	Maximum Concentration ($\mu g/m^3$)		Recorded Violations of NAAQS Annual Arithmetic Mean
		1-Hour	24-Hour		1-Hour	24-Hour	
Bullhead City	224 N. Main St.	5,534	--	27[a]	193	59	0
Davis Dam	DRI Mountain	6,994	--	22	97	32	0
Grand Canyon Village	Grand Canyon	--	18	19[b]	--	42	0
Hopi Point	Grand Canyon	--	17	9[b]	--	21	0
Katherine's Landing	Davis Dam	5,246	--	24[a]	116	38	0
Riveria	Fort Mohave	3,437	--	22[a]	97	26	0

Source: Arizona Department of Health Services, 1979 Air Quality Data for Arizona (December 1980).

-- No data available.

a/ Annual values based on a limited number of samples.

b/ Annual value; samples limited by relocation or later installation of the monitoring site.

because they represent less than 1 percent of the total Mohave County emission inventory of particulates. Finally, the small corrals scattered throughout the ranching areas of Mohave County contribute small, localized dust during roundups.

Violations of the NAAQS have occurred because of extremely high particulate levels during dust storms. One particularly severe dust storm on June 17, 1975, produced particulate concentrations from 200 micrograms (µg) per cubic meter to 1,800 µg per cubic meter south of the project area in Mohave County. Storms such as this require dust storm warnings from the Arizona Highway Patrol. Because of the high dust levels, only mountain areas near the proposed project consistently meet Federal and state standards for particulates. The Arizona Department of Health Services has instituted procedures to prevent particulate concentrations which would cause significant harm to the health of individuals. These procedures include public notification (air pollution alerts), increased departmental monitoring, and forecast responsibilities.

Sulfur oxides, nitrogen oxides, carbon monoxide, and nonmethane hydrocabons are not emitted in significant amounts in Mohave County. The two major sources of SO_2 in the vicinity of the project area are the Duval Mine, emitting 1,323 tons of SO_2 per year, and the Mohave Generating Station west of Bullhead City. The only other source of SO_2 in the project area is Lake Havasu Materials Industry, which emits 1 ton per year; this industry is also the only source of NO_2 emissions (3 tons per year). Among the other criteria pollutants, hydrocarbons (12 tons per year) are emitted at the Duval Mine. Carbon monoxide is not emitted in significant amounts by any point source.

Carbon monoxide, nonmethane hydrocarbons, and nitrogen oxides, all products of combustion, are concentrated near major roads and highways, especially around urban areas of Mohave County. Nitrogen oxide concentrations are very low in comparison to the Federal and Arizona state annual standard of 100 µg per cubic meter. The highest recording of nitrogen oxides occurred at the Davis Dam and Bullhead City, reflecting the concentrations of both recreational vehicles and tourist traffic that enter these areas in the summer. Nevertheless, no violations of the NAAQS for SO_2 and NO_2 were recorded in Mohave County in 1980.

According to EPA definition, Class I areas, where existing air quality cannot be degraded by new development, include:

> International parks.

> National wilderness areas which exceed 5,000 acres.

> National memorial parks which exceed 5,000 acres.

> National parks exceeding 6,000 acres which were in existence on August 7, 1977.

These areas are given more protection under the Clean Air Act (i.e., the incremental emission allowances are more restrictive for new sources). The Class I area closest to the Red Lake site is the Grand Canyon National Park, about 40 miles to the northeast.

C. TOPOGRAPHY AND GEOLOGY

1. Topography

Hualapai Valley is a closed surface drainage basin. It lies in a transition zone between the Colorado Plateau to the east and the Basin and Range province to the west. It is bounded on the west by the Cerbat Mountains and the White Hills and on the east by the Grand Wash Cliffs and the Music Mountains of the Colorado Plateau province. Figure 11 shows the physiography of the project area; figures 2 and 6 show the regional and local topography, respectively. To the south, the Peacock Mountains and the Hualapai Mountains border the valley, while a low topographic divide restricts surface drainage to the north. Red Lake is a playa located near the northern end of the valley. It is the remnant of a more extensive permanent lake.

The lowest elevation in Hualapai Valley at the level and featureless surface of the Red Lake playa is 2,754 feet above sea level. The playa covers approximately 20 square miles. Alluvial fans and pediments rise from the playa to the bases of the surrounding mountains at elevations of 2,800 feet to 3,200 feet.

Long Mountain is the largest of several isolated hills in the southern portion of Hualapai Valley. The valley floor at the south end of the valley is approximately 3,200 feet high and slopes northward toward Red Lake at an average drop of 20 to 30 feet per mile. Local relief along the proposed pipeline route is a few feet at dry stream channels and at various scattered dunes.

2. Geology

The Cerbat Mountains are a tilted fault block characteristic of the Basin and Range. The Grand Wash Cliffs, an expression of the Grand Wash fault, one of the major faults in northwestern Arizona, represents the western edge of the Colorado Plateau. The crest of the Grand Wash Cliffs is at 6,000 feet in the north end of the valley and 6,677 feet at the summit of the Music Mountains, the southernmost portion of the cliffs.

The consolidated rocks of the mountains surrounding Hualapai Valley consist of igneous intrusives and metamorphic, sedimentary, and volcanic rocks. (Figure 23, which shows the hydrogeology of the project area, also identifies the locations of these rock types.)

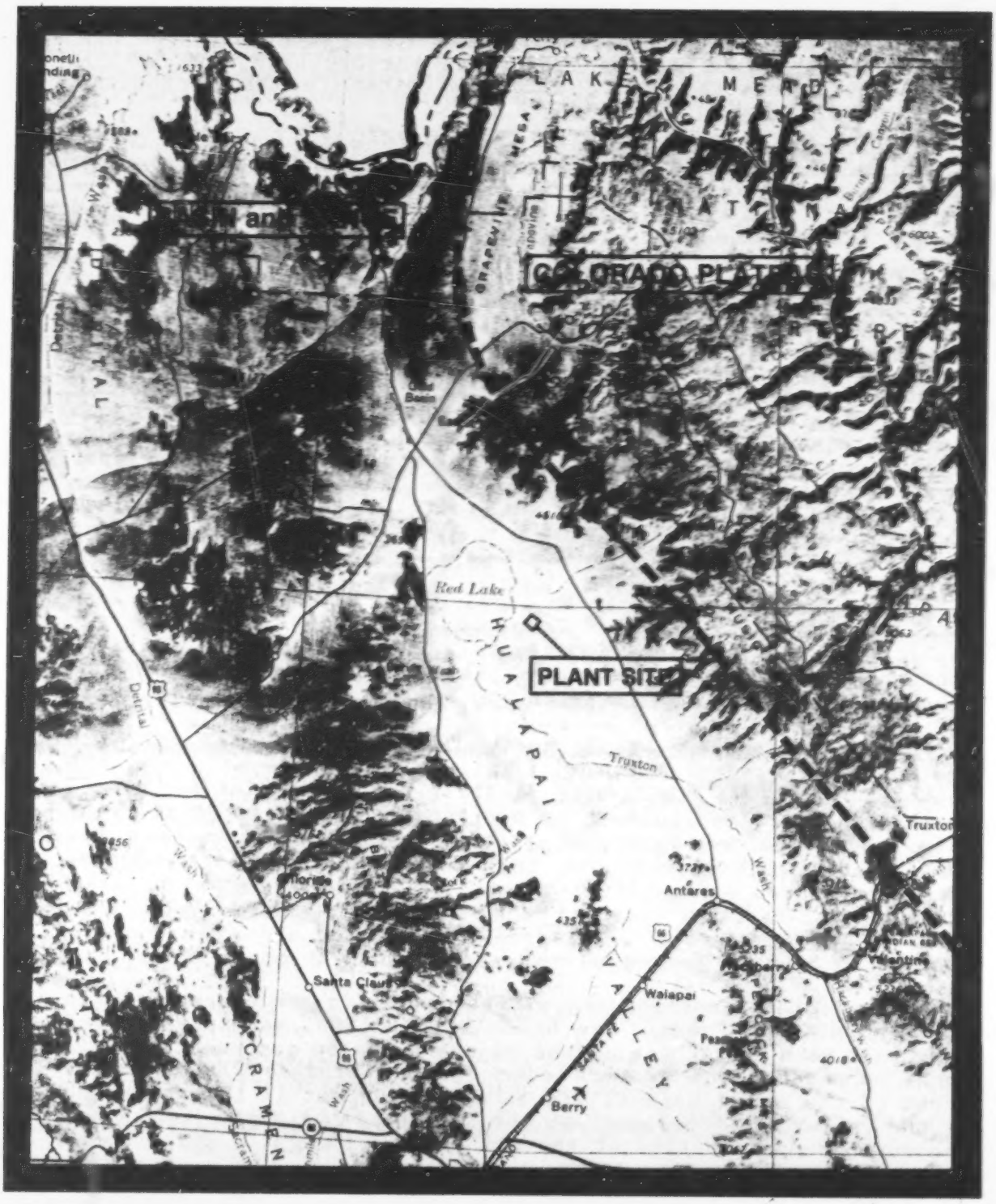

Figure 11
Physiography of Project Area

The oldest rocks exposed in the mountains are granite gneiss and schist of Precambrian age. (See table 6 for an explanation of the geologic time scale.) Interspersed in these deposits are small granitic intrusions. Other intrusives are Late Cretaceous to early Tertiary in age.

Sedimentary rocks of Paleozoic age which cap the Grand Wash Cliffs consist of the Tonto Group--the Tapeats Sandstone, Bright Angel Shale, and Muav Limestone, with Devonian limestone above.

The alluvial deposits in Hualapai Valley are divided into the older alluvium of Tertiary age, the intermediate alluvium of late Tertiary and Quaternary age, and younger alluvium of Quaternary age. The older alluvium is the principal aquifer in Hualapai Valley. It consists of moderately consolidated fragments of granite, schist, gneiss, and volcanic rocks in a brownish-gray silty clay or sandy matrix and contains interbeds of weakly consolidated volcanic ash deposits. The grain size decreases from pebble- and boulder-size fragments in the deposits near the mountains to coarse sand and interbedded clay and silt in the bottom of the valley. The playa materials are primarily silty clay.

a) Cavern/Compressor Site

The presence of halite in Hualapai Valley was first confirmed in 1958 when the Kerr-McGee Corporation (Kermac) sank two mineral exploration holes to the southeast of Red Lake (figure 6). One hole cored about 1,200 feet of coarsely crystalline halite, the other about 635 feet of similar material. The top of the salt was about 1,400 feet below the surface. A third exploratory well was drilled nearby in 1970 by El Paso. That well hit salt at approximately 1,500 feet and bottomed out in salt at about 6,000 feet, proving that the salt section is at least 4,500 feet thick in that area of the valley. Recent seismic profiling across the valley has made it possible to map the structure contours and formation thickness of the salt deposit (figure 12; also Appendix B, "Seismic Survey"). The salt deposit is a wedge-shaped body, thinning to the west and fault bounded to the east, where it is more than 7,000 feet thick. The salt body is approximately 5,000 feet thick 1,450 feet below the surface of the proposed cavern site.1/

The seismic survey also suggests that the Cerbat Mountains are a series of thrust plates--that is, the geologic structure below the Cerbat Mountains and the western side of the valley is

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1/ The isopach map (appendix B, figure B-3) also includes what is interpreted to be Lower Tertiary on figure 12.

TABLE 6

GEOLOGIC TIME SCALE

Relative Duration of Major Geologic Intervals	Era	Period	Epoch	Approximate Duration in Millions of Years	Millions of Years Ago
			Holocene	Approx. the last	10,000 years
Cenozoic		Quarternary	Pleistocene	2.5	2.5
			Pliocene	4.5	7
			Miocene	19.0	26
Mesozoic			Oligocene	12.0	38
			Eocene	16.0	54
	Cenozoic	Tertiary	Paleocene	11.0	65
Paleozoic					
		Cretaceous		71	136
		Jurassic		54	190
	Mesozoic	Triassic		35	225
		Permian		55	280
		Carboniferous	Pennsylvanian	45	325
			Mississippian	20	345
		Devonian		50	395
		Silurian		35	430
		Ordovician		70	500
	Paleozoic	Cambrian		70	570
Precambrian	Precambrian			4,030	

0 — 50 — 100 — 150 — 200 — 250 — 300 — 350 — 400 — 450 — 500 — 550 — 4,600

a complex of Paleozoic and Mesozoic sedimentary rocks and not uninterrupted Precambrian basement rocks, as previously assumed (figure 12). Pataya considers seismic profile lines 2, 3, and 4 proprietary.

b) Evaporation Pond Site

Red Lake is a "fine-grained" playa, characterized by (1) deposits of medium silt through fine clay size, (2) slow artesian and capillary movement of water through the surface, (3) mostly smooth, hard surface, and (4) current formation of giant desiccation polygons.[1/] It is also a hydrologic "bypass" playa, which means that it is underlain by an aquifer which discharges most of its flow to places other than the playa surface (Lake Mead, in this case).

Giant mud crack systems, also called giant desiccation polygons, and other evidence of earth fissuring are conspicuous geologic features in and around Red lake. (See figures 13 and 14.) A detailed investigation of the cracks in the vicinity of the evaporation pond site was conducted by the FERC staff in February 1982 in cooperation with representatives of the applicant to evaluate the possible impact of the cracks on pond operation. The study involved high resolution aerial photography of the area (natural color and color infrared imagery, scale 1:6000), photograph interpretation and overlay mapping of suspected crack features, and exploratory trenching at selected locations, shown in figure 15. Flooding on the playa during the field investigation prevented detailed examination of trenches 8, 9, and 10, but the features in those areas are inferred to be cracks.

At least two geometrically distinct crack systems are recognizable. The rather widespread cracks, which occur in an irregular orthogonal pattern forming polygons which vary from 200 feet to over 2,000 feet in diameter, and the curvilinear features which form part of a concentric ring pattern to the north of the proposed pond site (figure 14). Individual cracks range from a few hundred to several thousand feet long. Those which are visible in the terrain surrounding the playa are marked by vibrant growth of xerophyte shrubs (such as shadscale and saltbush) and taller grasses. (See figure C-1, appendix C.) The unvegetated cracks on the playa are either invisible from ground level or are marked by subtle tonal and textural variations in the playa surface sediments. (See figure C-2.) The surficial expression of the cracks off the playa varies from fresh open fissures, which are

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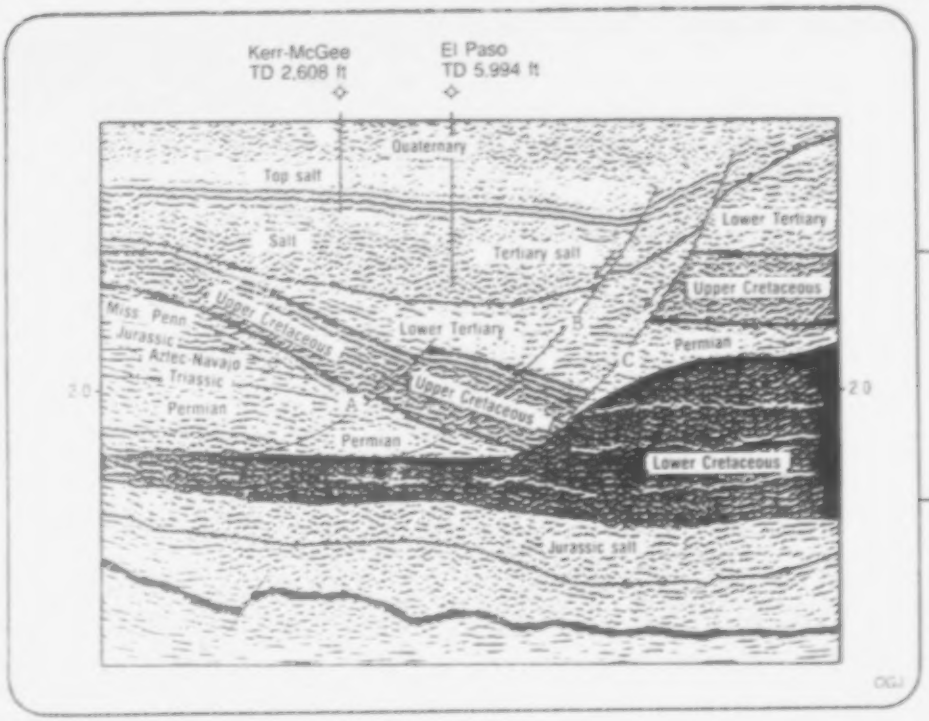
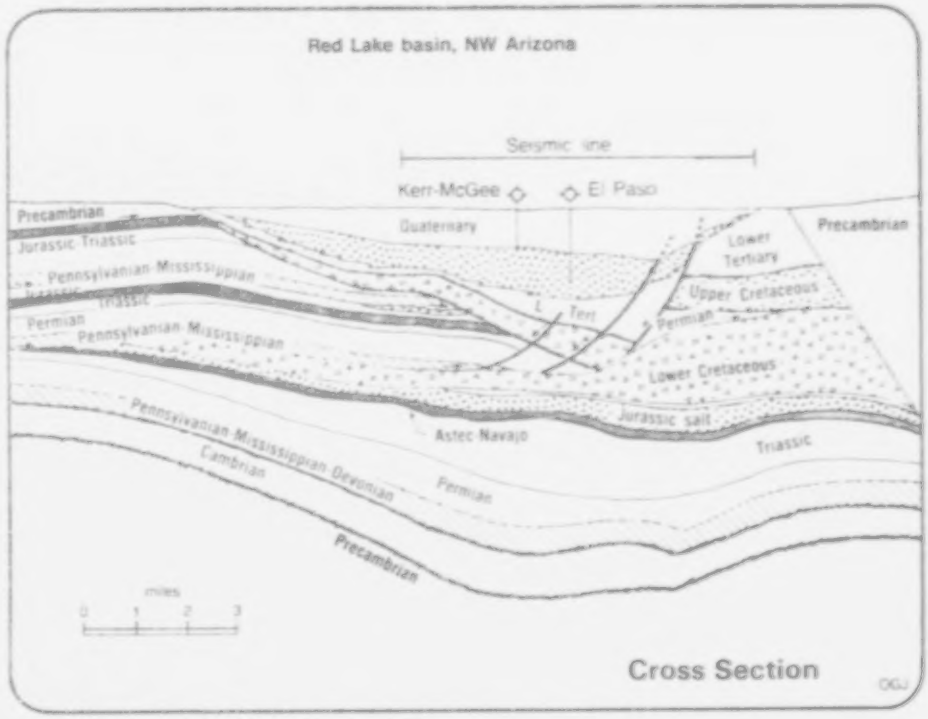
1/ "Some Hydrologic and Geologic Processes Influencing Playa Development in Western United States," in Playa Lake Symposium, ed. C. C. Reeves, Jr., Lubbock, Texas (1970).



KEY

TD--Total Depth

A, B, C--Unnamed Faults



Source: Harlan, Masters, and Charles, "Uplift Across Overthrust Hingeline Belt," *Oil and Gas Journal*, (November 24, 1980), p. 166.

Figure 12
Seismic Line Number 1: Red Lake Area

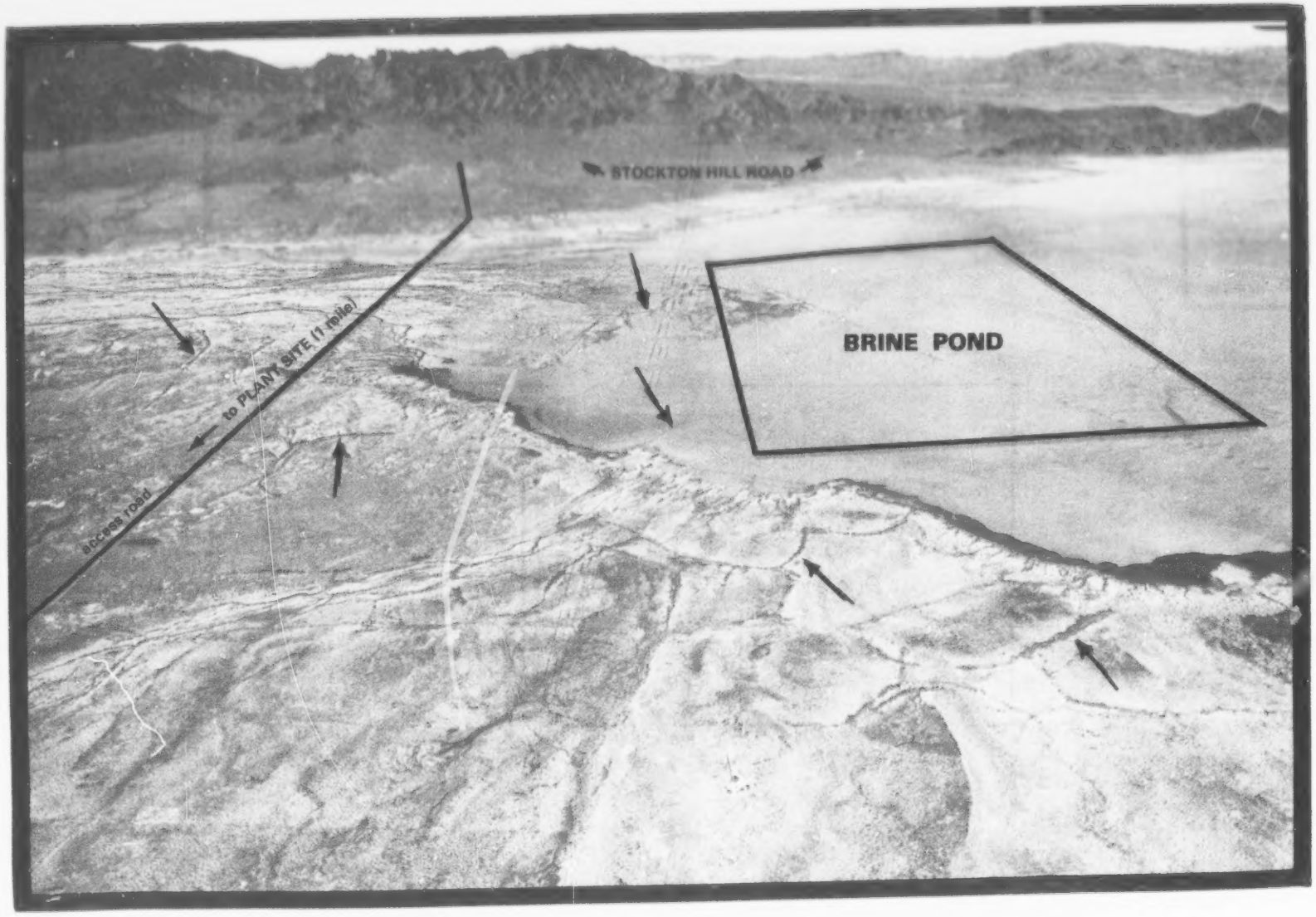


Figure 13

Large Desiccation Cracks Near Proposed Site

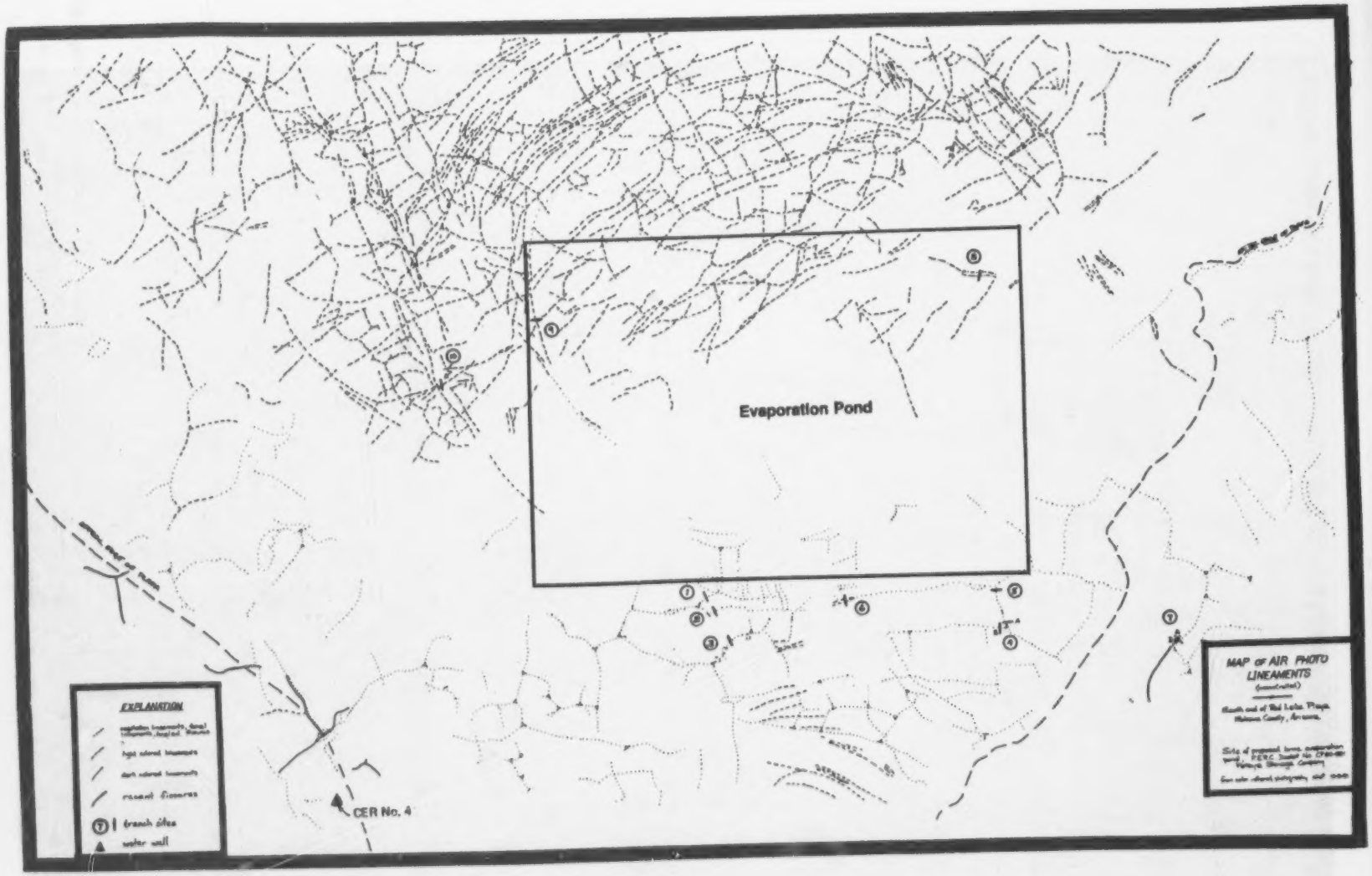
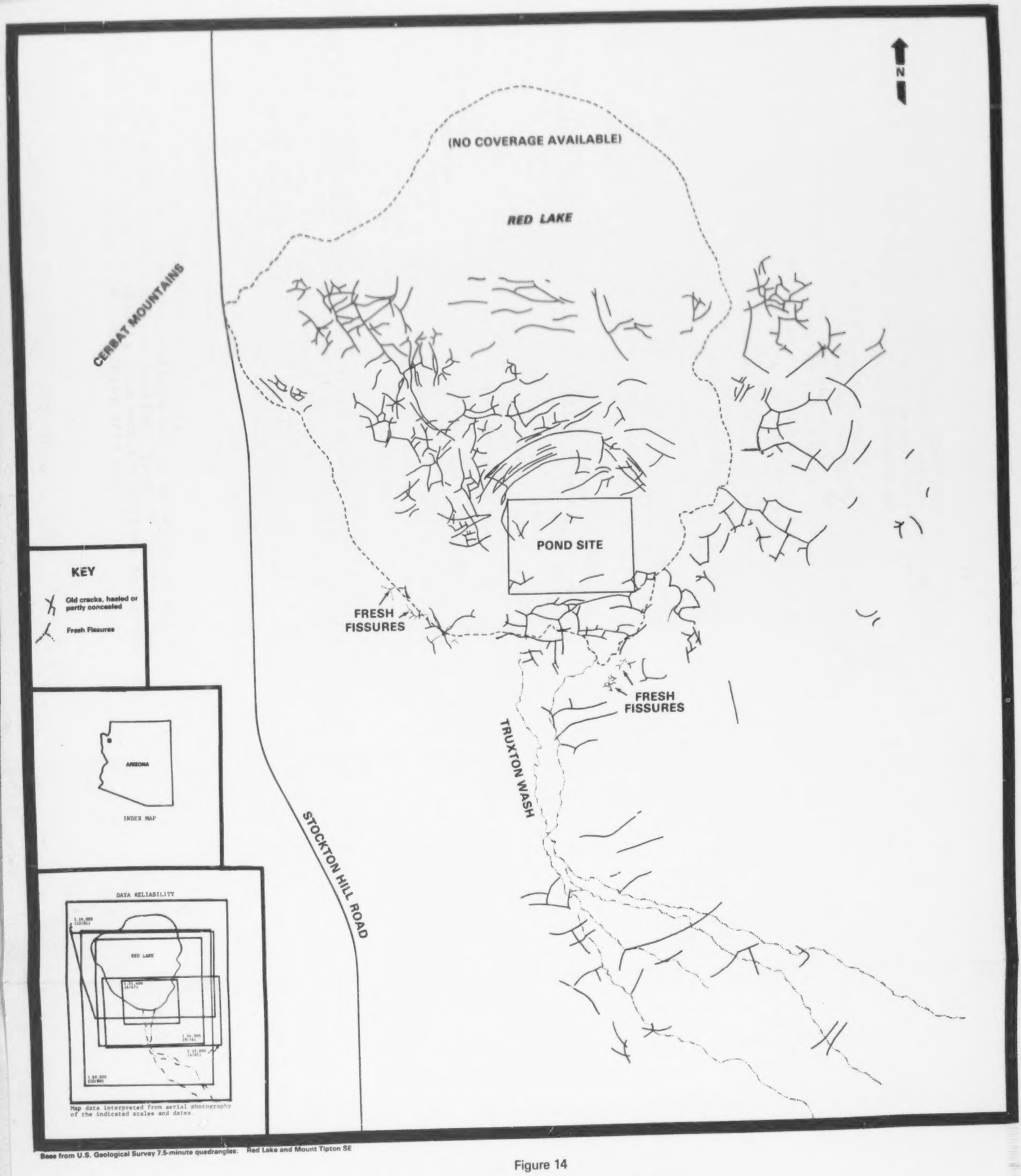


Figure 15

Detail of Crack Pattern in Vicinity of Evaporation Pond Site and Location of Exploratory Trenches



Base from U.S. Geological Survey 7.5-minute quadrangles: Red Lake and Mount Tipton SE

Figure 14

Generalized Map of Giant Desiccation Cracks and Playa Fissures

several inches to 3 or 4 feet across, to relatively wide (10 to 30 feet) shallow, linear depressions that resemble the many dry streambeds in the area and are, in some areas, part of the local drainage system. Some cracks are probably concealed.

The polygonal crack pattern is evidence of deep seated desiccation, believed to have formed as a result of long-term decline in the groundwater level and subsequent shrinking of the clayey deposits. The ring pattern is believed to be the remnants of tension cracks which formed at the edge of an area of local subsidence. Whether this subsidence is continuing is unknown; the surficial appearance of the ring fissures suggests that they are relatively old, and no recent fissuring is evident in that area. On the other hand, aerial photographs and published information indicate that the polygonal cracking is an ongoing, perhaps periodic (intermittent) process. Many of the large cracks are at least 40 years old and probably much older (perhaps thousands of years), yet crack formation is continuing today. The most recent fissuring, which occurred sometime in the latter half of 1981, may have been caused by aquifer testing. (See figure 15 and figures C-5 through C-10.)

The following prominent features were observed in the exploratory trenches (average depth of excavation 6 feet). First, the cracks are "healed"--filled with fine-grained material that has caved in from the sides or was washed into the fissure, as shown in figure 16. Second, the crack filling commonly shows evidence of ponding, and finally, the cracks tend to narrow with depth. However, evidence of juxtaposed cracks suggests that existing cracks might be probable locations for new fissuring. Several of the large healed cracks to the east of the playa show this clearly. The recent fissures at the southwest and southeast edges of the playa also show a tendency to parallel existing cracks, as illustrated in figure 17, and there is evidence of this phenomenon on the pond site.

The maximum depth of the fissures is still unknown, but it may vary considerably. The longer fissures are probably deeper. A recent fissure off the southwest edge of the playa was more than 18 feet deep (limit of measuring tape) and at least 0.5-inch wide at that depth. It is likely that many fissures are significantly deeper; some may extend to the vicinity of the saturated zone--250 feet or more at the pond site.

c) Seismicity and Faulting

Hualapai Valley is at the southern end of a region known as the Intermountain Seismic Belt--a distinct zone of faulting and earthquake activity which extends from western Montana to northwestern Arizona. (Figure 18 identifies this belt.)

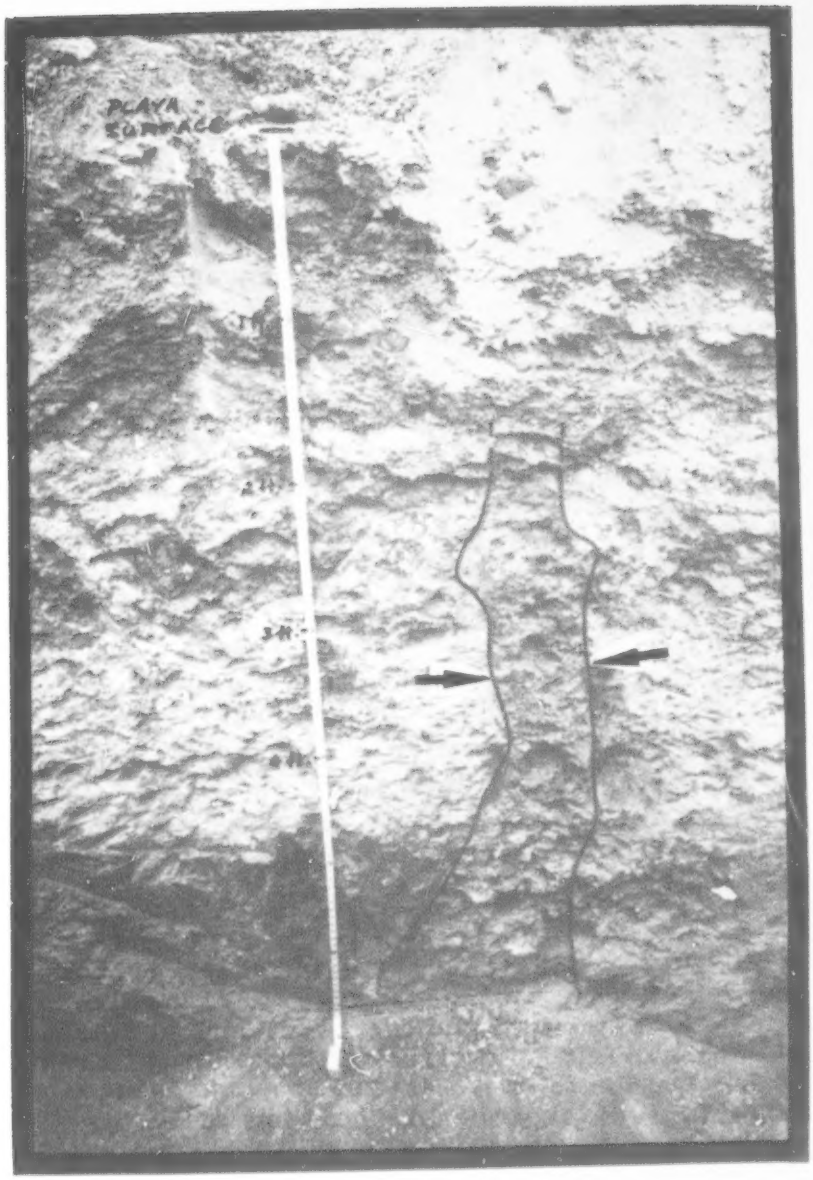


Figure 16

Healed Crack in Trench No. 5

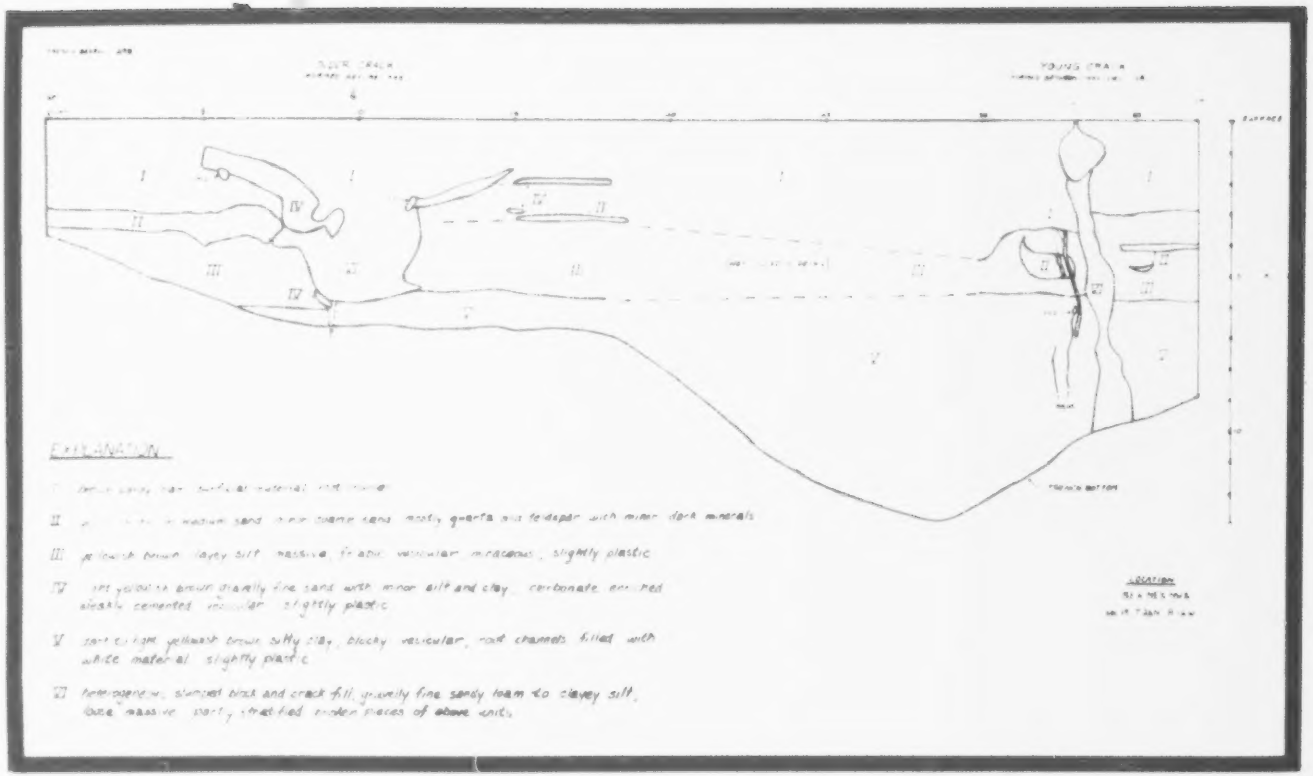
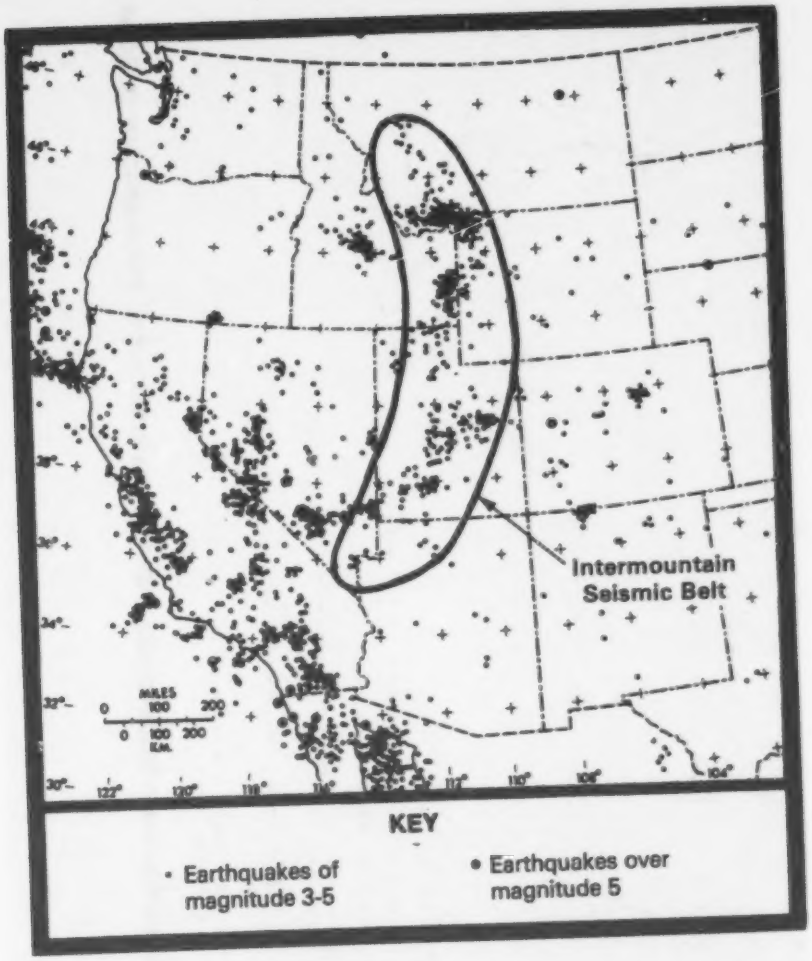


Figure 17

Log of Exploratory Trench 7A



Source: U.S. Army Waterways Experiment Station.

Figure 18
Earthquake Epicenters in Western North America: 1961-1970

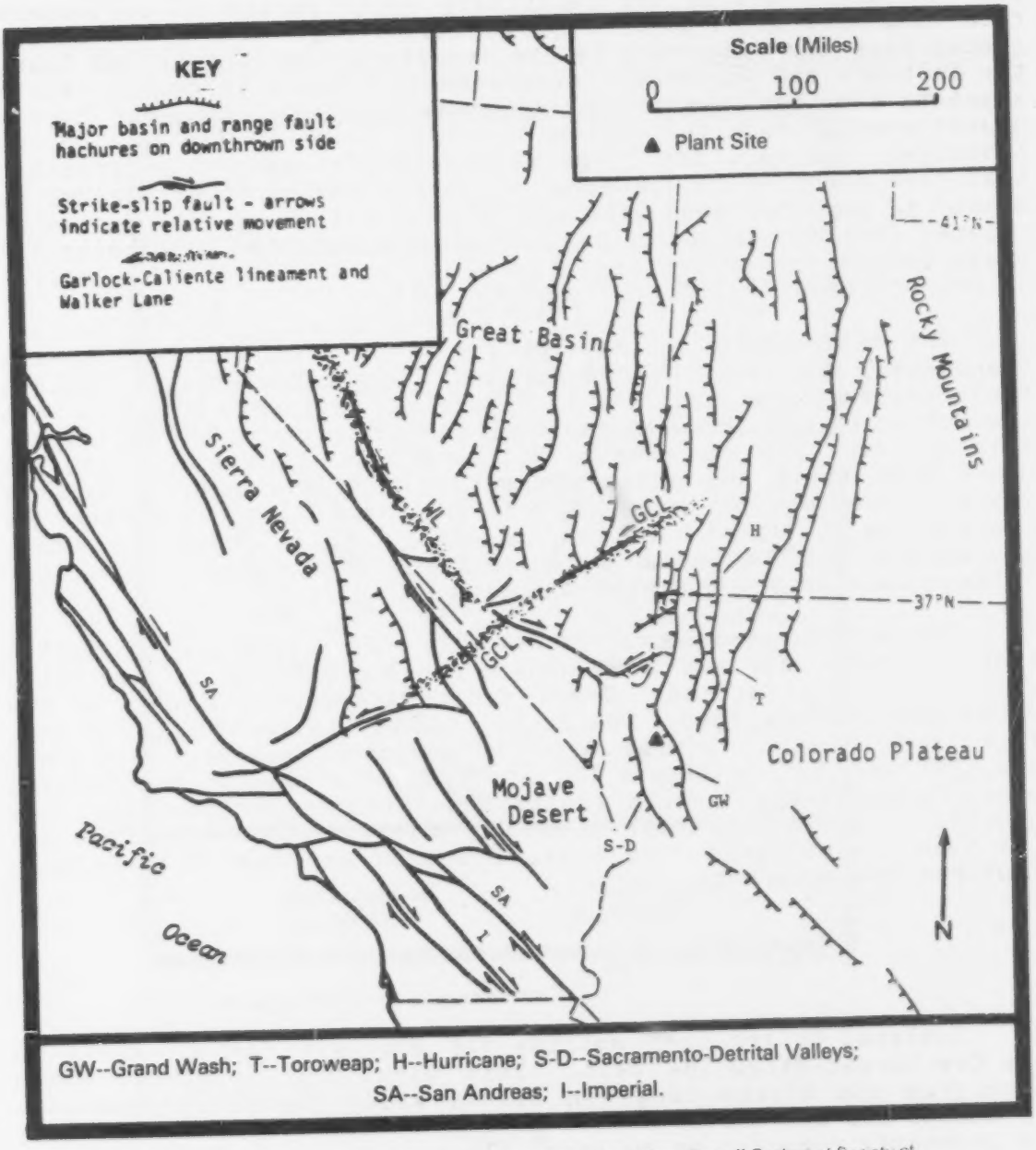
The area immediately surrounding Hualapai Valley has historically experienced a low level of seismic activity. However, seismic quiescence within the relatively short period of earthquake recording does not indicate fault inactivity. While few earthquakes have been recorded in the immediate vicinity of Red Lake, the Tertiary and Quaternary displacement history on nearby faults suggests that the region is indeed tectonically active. Earthquakes greater than the largest recorded event are, in fact, quite possible. However, the large events (magnitude 6.0 or greater) that have occurred in southern California and northwestern Mexico appear to be associated with the San Andreas, Imperial, and other related faults; because of the distance between the plant site and these faults, recurrent activity would have little or no effect on the proposed facility.

The major faults in the vicinity of the proposed project--the Grand Wash, Hurricane, Toroweap, and Sacramento-Detrital Valleys fault systems--are indicated on figure 19. Evidence suggests that the Hurricane and Toroweap fault systems have been recurrently active at least from Miocene to Holocene time. Movement along the Grand Wash fault has not occurred for approximately 10 million years in the project area, but it may have occurred during the Pleistocene or later in the vicinity of St. George, Utah, approximately 100 miles north of Red Lake. The Sacramento-Detrital Valley fault cuts Quaternary alluvium.

The seismic profile of the Red Lake area (figure 12) indicates that the salt body and some undetermined thickness of overlying valley fill are faulted. These faults are probably part of the Grand Wash fault system. One fault ("A" on figure 12) is, in profile, approximately 1 mile from the proposed caverns. The other two ("B" and "C" on figure 12) are approximately 1.5 and 2 miles away, respectively. While faults B and C displace the salt body upwards to the east, their possible extension to the surface has not been investigated. No obvious scarps or other active fault features are apparent.

d) Economic Geology

Hualapai Valley lies astride the geologic feature known as the Overthrust-Hingeline Belt. This structural province, which runs from the Brooks Range in Alaska along the Rocky Mountains in Canada and the United States through Mexico to Central America, is presently regarded as an ideal place to search for oil and gas. The most recent U.S. Geological Survey estimates of undiscovered



Modified from R.W. Greenfelder *et al.*, "Seismotectonic Regionalization of the Great Basin," Geological Society of *America Bulletin* (September 1980), p. 519.

Figure 19

Major Faults Near the Proposed Project

recoverable conventional petroleum resources in the Colorado Plateau and Basin and Range region (of which the Overthrust-Hingeline Belt is the primary exploration frontier) are 14.2 billion barrels of oil and 90.1 trillion cubic feet of natural gas.[1/]

Much of the public land in and around Red Lake and the proposed plant site has been leased for oil and gas exploration and development. There are 23 oil and gas leases currently in effect, covering approximately 77 square miles in the immediate vicinity of Red Lake. Four of these leases expire in May 1983, the others in March 1988. So far, little if any exploratory drilling has been done.

The fact that a large salt body underlies a sizeable portion of Hualapai Valley has led the BLM to designate an area southeast of Red Lake as a halite resource area, though no halite mining has occurred yet. A quartz resource area has also been identified southeast of the proposed project site.

A substantial amount of mining has occurred in and around the mountains in the Kingman area. There are approximately 700 active mining claims in the 1.2 million acres of the BLM Cerbat/Black Mountains Planning Unit. Gold, silver, copper, lead, molybdenum, zinc, and some gemstones have been recovered in the area. Annual production as of 1977 has been less than $1 million for each commodity.

D. SOILS

The most detailed soil map of the project area is a 1974 general soil survey of Mohave County which is not detailed enough for site-specific analysis. The soil in Red Lake, which encompasses approximately 20 square miles, is distinct from the soil of the surrounding valley floor and is not identified in the general survey. Much of the information used in this analysis was obtained by the applicant and the environmental staff during its inspection of the project site.

1. Storage Site, Access Roads, Gravel Pits

The soils of Hualapai Valley developed from water-transported sand, silt, and clay. These sediments have a high content of carbonates and sulfates, which cause the silt and clay particles to be fluffy and easily blown by wind. Truxton Wash, the principal south-to-north drainage in Hualapai Valley, may have migrated from the east of the valley to the west as the valley floor

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1/ U.S. Department of the Interior, "News Release" (Washington, D.C., February 25, 1981). Figures are mean value estimates.

tilted, resulting in fluvial deposition across the valley floor. Additional sediments were deposited by east-west trending washes from Grand Wash Cliffs on the east side of the valley and the Cerbat Mountains on the west. Sand dunes formed as the wind reshaped the sandier fluvial deposits. This complex interaction means that the soil varies considerably from place to place.

The gas storage plant would be located on a 20-acre site on the valley floor, approximately 2 miles east of the south end of Red Lake and about 40 feet higher in elevation. A 6.5-acre portion of this site would house the gas compressor units, regulator and dehydration units, hydrocarbon storage tank, aboveground water storage pond, and associated facilities. According to a study by the applicant's engineering consultant, most of this area has a silty clay surface soil from 4 to at least 24 feet deep. Below this are strata of clayey silt, sandy gravel, and other textures. The study, which included a number of tests, concluded that the silty clay surface soil is unsuitable for the foundations of the proposed facilities because the soil would settle excessively when saturated under the expected foundation loads. Therefore, engineered fill would be used under the heavily loaded foundations.

Two site access roads are proposed. One road would be constructed between Stockton Hill Road and the plant site, to be used primarily during construction; the second road would be designed for all-weather access between Antares Road and the plant site. An engineering study was conducted on the 5-mile long Stockton Hill-plant site route to determine the feasibility of using this for a permanent, all-weather access road. The sandy to clayey soils found along the route were determined to be unsuitable for supporting the heavy five-axle propane trucks that would use the road, especially in the vicinity of Truxton Wash, which has expansive and compressible clays subject to periodic flooding. The consultant recommends that engineered fill be installed under the road bed and that culverts be used to allow flood water to pass.

All of the engineered fill for the facility foundations and the evaporation pond rip rap would be obtained from sand and gravel deposits in the nearby alluvial fan of the Cerbat Mountains in sections 19 and 29, T.26N., R.17W. These deposits range from superficial to at least 10 feet deep; in some areas, cemented materials and boulders occur within 3 to 6 feet of the surface. Approximately 460,000 cubic yards of fill could be obtained from these sites.

2. Evaporation Pond

The proposed evaporation pond would be constructed on the surface of Red Lake, a flat, 20-square mile ephemerally wet lakebed. During wetter climatic periods, the lakebed was much

larger than the current borders. The lakebed sediments, which are salty and alkaline at least in the upper 5 feet, are known to be at least 628 feet thick near the center of the playa. They are composed primarily of clay and silty clay, although more permeable zones of sand, gravel, or other materials are present.

The staff studied six profiles of the playa soil within and near the proposed pond site. (See figure 15.) The studies were conducted to determine the characteristics of the soil and to investigate the giant polygonal cracks. (These cracks are discussed in section C.2.b.) The profiles revealed marked variability in the playa soil. All of the profiles show a loose, platy, silty clay topsoil ranging from 18 to 24 inches deep. Below this depth, the subsoils range from a uniform, massive, and prismatic clay and silty clay, indicative of a young, undeveloped soil (Torriorthents or Torrifluvents) to a more complex, stratified subsoil with horizons of calcium carbonate, indicative of a more highly developed soil (Calciorthids). The latter soils, which occur near the center of an area demarcated by remnant ring-shaped fissures, would not normally develop in a playa. Rather, they are characteristic of soils formed on alluvial fans and terraces, suggesting that this portion of the playa subsided to its present position after the soil developed.

The staff theorizes that the platy topsoil found throughout the pond site has been formed by moderate swelling and shrinking as the soil becomes alternately wet and dry. A graph of the moisture profile of the playa soil in April 1981 (figure 20) shows that while the moisture content increases dramatically from the surface to approximately 20 inches, it becomes more uniform below 20 inches.1/ This evidence, coupled with a laboratory analysis of the topsoil which shows that the soil reaches its minimum volume--i.e., its shrinkage limit--at 12 to 14 percent moisture, supports this theory.

Soil samples were obtained by the applicant, and a number of tests were performed to assess the suitability of the playa for construction of the pond. Briefly, the test results indicate the following.

> The permeability of undisturbed samples of the soil to brine, from a soil depth of 1 to 2 feet (a 12-inch vertical column beginning 1 foot below the surface), averages 0.057 inch per hour. The permeability to brine following maximum compaction of the soil is less than 0.000002 inch per hour. The permeability

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1/ In addition to this test, samples from 250 feet and 305 feet below the surface had a moisture content of 18.3 and 25.5 percent, respectively.

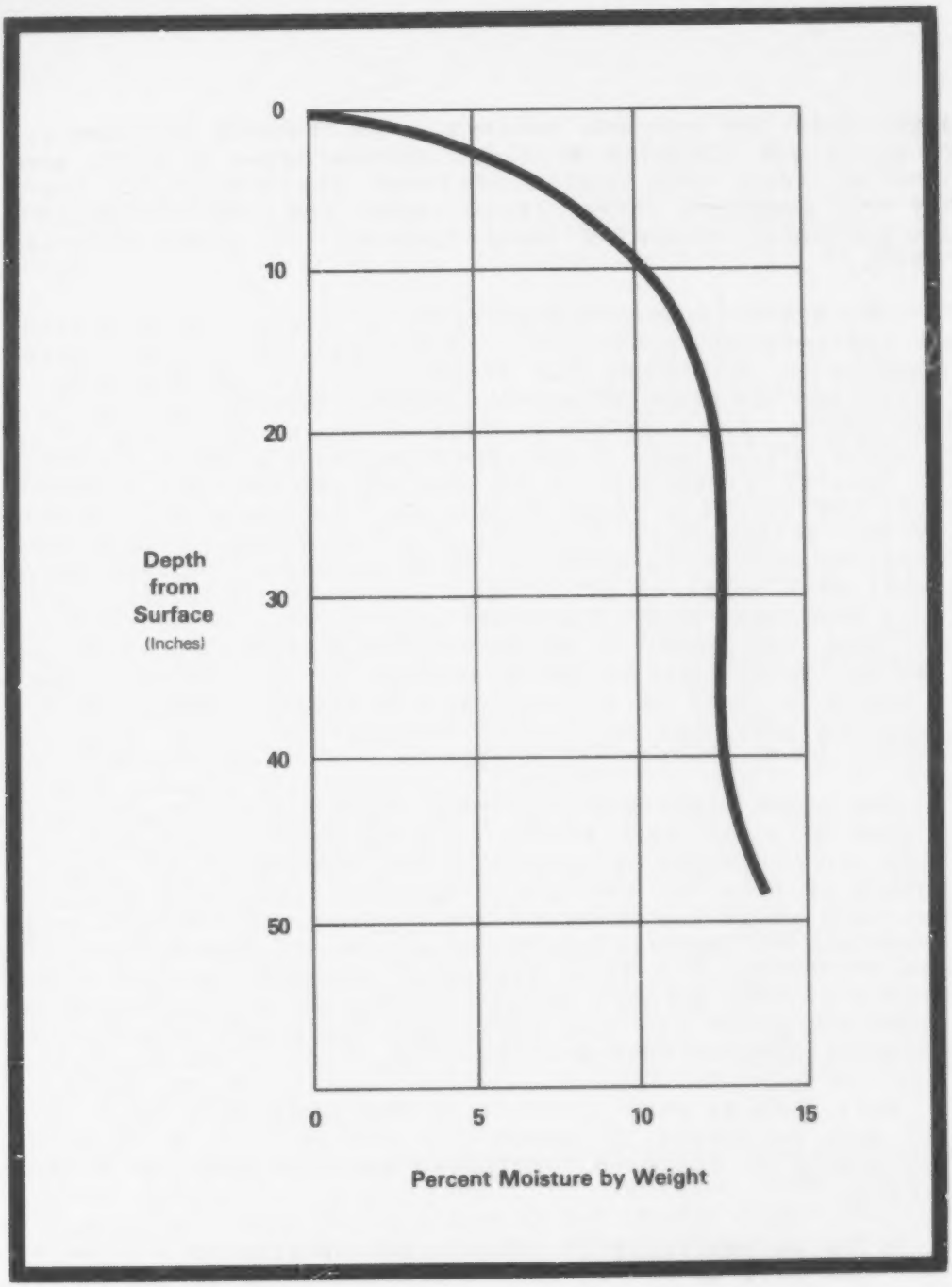


Figure 20

Approximate Moisture Content of Red Lake Playa Sediments at the Proposed Evaporation Pond Site, April 24, 1981

of the undisturbed samples should be considered only an approximate value because sampling techniques disturb the soil somewhat, affecting the permeability.

> Three direct field permeability tests using brine solution in a 5-inch diameter pipe inserted 40 inches below the surface indicate an in-situ coefficient of permeability ranging from 0.03 to 0.14 inch per hour.

> The soil texture from the surface down to 1 foot ranges from clay to silty clay. The top 18 inches of soil at three locations below the proposed perimeter dike are a CL material (inorganic clays, low to medium plasticity) under the Unified Soil Classification System.

> The optimum moisture content for maximum mechanical compaction of the soil lying within 2 feet of the surface ranges from 19 to 20.2 percent moisture by weight. The maximum dry density determined by the ASTM D1557 ranges from 106 to 108 pounds per cubic foot.

> A consolidation test to determine the potential amount of settlement of the in-situ playa soil beneath the proposed pond dikes indicates that about 0.5 inch of settlement could occur before the pond was filled. Additional settlement of about 2.2 percent of the depth of saturation below the pond floor could occur. Two additional consolidation tests of remolded samples from the upper 18 inches of the playa, compacted to 90-percent relative compaction, loaded and then wetted during testing, indicate a range of settlement from 1 to 4 percent of the depth of saturation. Unloaded samples swelled to 3 percent of the depth of saturation.

> Direct shear test on remolded and compacted samples indicate favorable shear strength for conservative dike design.

> A preliminary X-ray diffraction analysis of the clay minerals indicates the clays are of the smectite clay group. These clays expand and contract upon changing moisture content.

> The soil from the surface down to 1 foot flocculates in brine solution--i.e., soil particles clump together. The soil disperses in fresh water.

> The exchangeable sodium percent--the soil's total capacity to adsorb cations on the surface of the clay particle taken up by sodium ions--from 1 foot to 2 feet below the surface is 3.8 percent.

In addition, the environmental staff conducted simple field tests during its site inspection in April 1981. These tests produced the following results.

> Upon contact with dilute hydrochloric acid, the soil effervesces violently, indicating a high content of carbonates. A field pH test indicated a pH of 8.6 or higher.

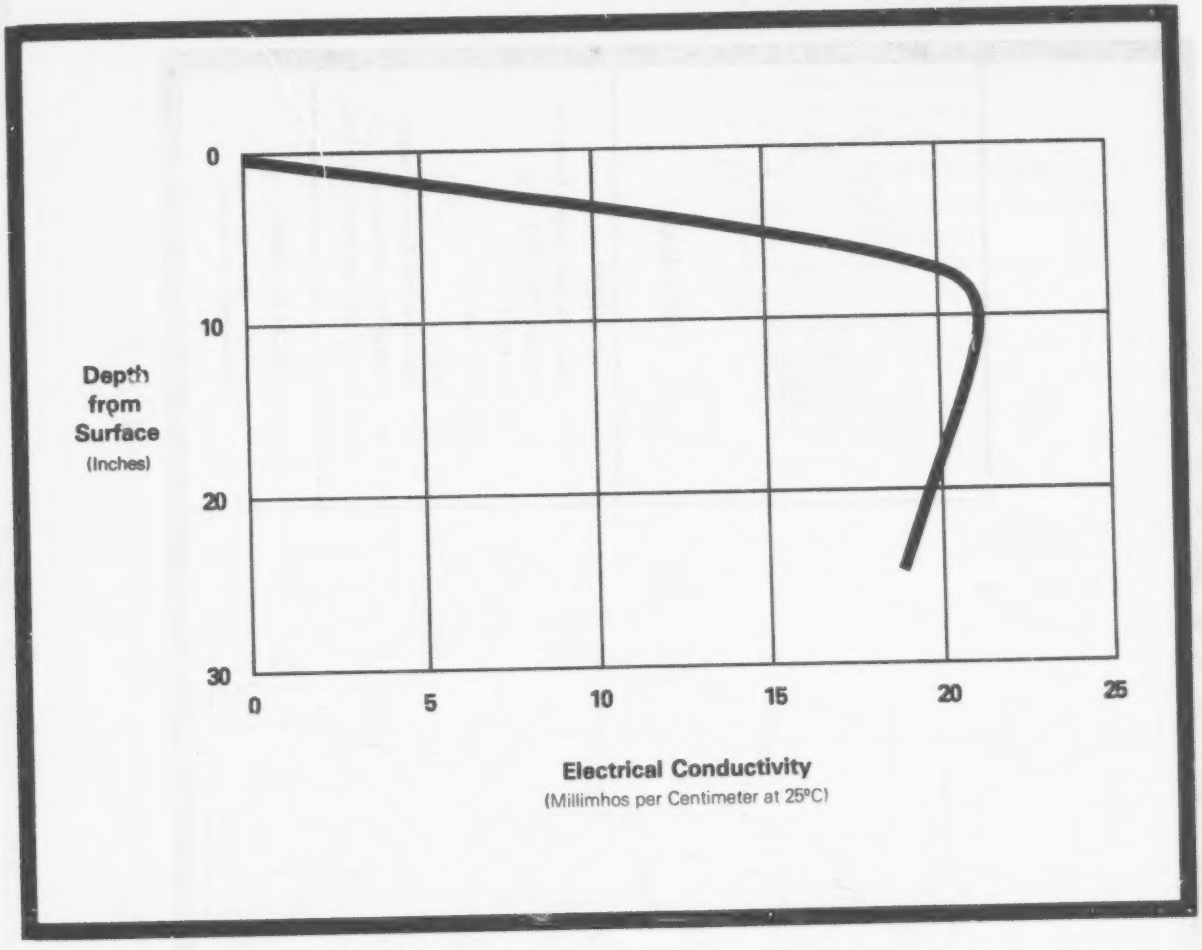
> Salt content of the surface inch of soil is relatively low, increasing dramatically to high levels in the first foot. (Figure 21 diagrams these levels.)

E. WATER RESOURCES

1. Surface Water

Hualapai Valley is in the Lower Mainstem Subregion of the Lower Colorado Region, shown in figure 22. The valley trends north-south, extending from the Hualapai Mountains on the south to a low topographic divide about 5 miles north of Red Lake. Truxton Valley, east of the Cottonwood and Grand Wash Cliffs, and a small valley to the south of where Truxton Wash passes through the Cottonwood Cliffs are tributaries to the Hulapai Valley and together with it form a basin of closed surface drainage. Figure 23 presents a generalized view of the hydrogeology of the area.

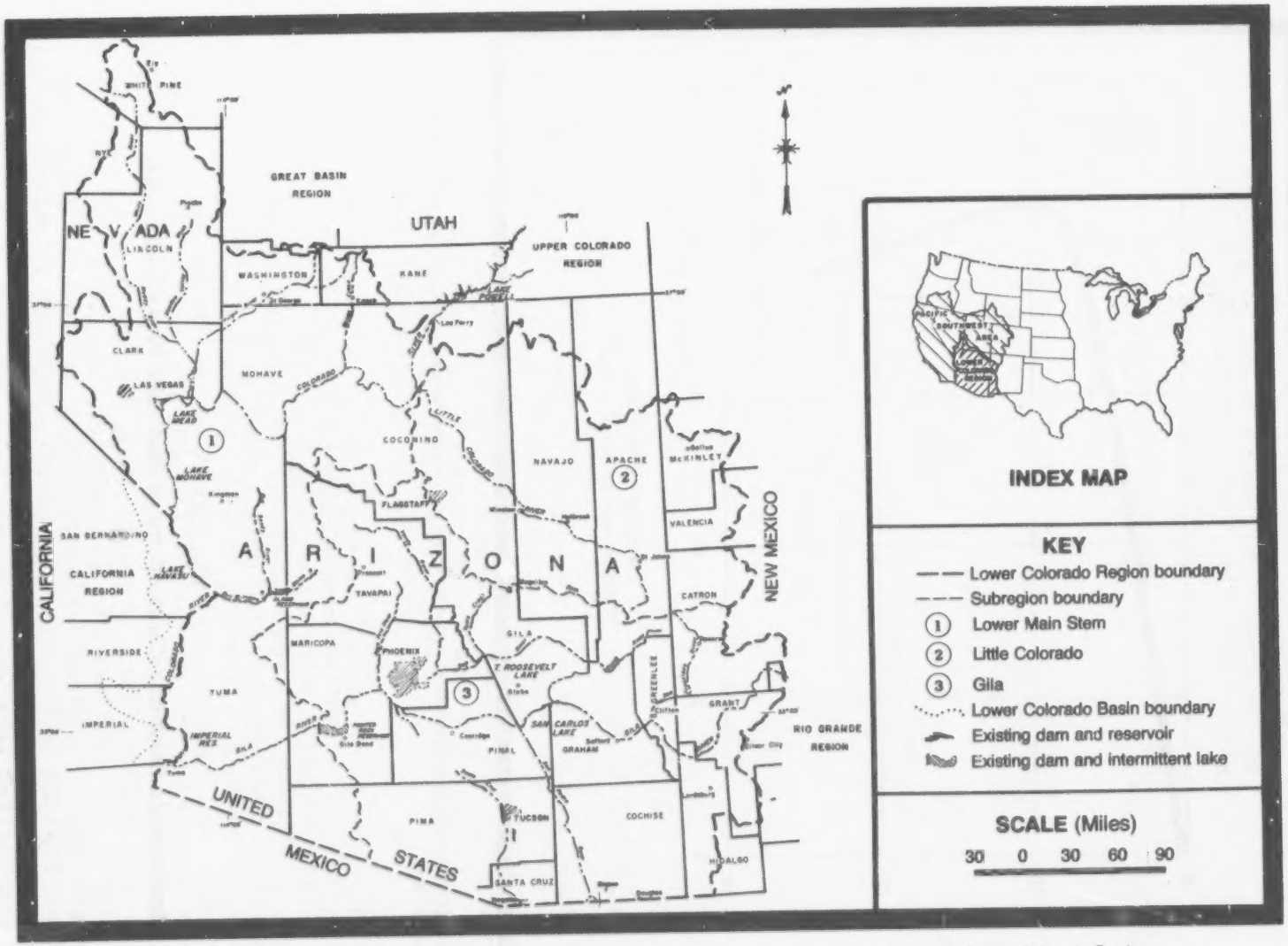
While the climate of Hualapai Valley is typically semiarid (average annual precipitation approximately 6 inches), subhumid conditions occur at the higher altitudes (average annual precipitation approximately 20 inches). Between these two extremes, rainfall typically increases with altitude because of the mountain geography. Consequently, runoff primarily depends on precipitation or snowmelt on mountain slopes adjacent to the valleys. Streams flow from the mountain canyons onto dissected alluvial fans and the valley floor. Below the streams' emergence from the canyons, the flows are diminished by infiltration and evapotranspiration. Although substantial streamflow can occur in the mountains because of high intensity storms, flows seldom reach the middle of Hualapai Valley. While a few streams in the surrounding mountains are perennial, the valley streams (including Truxton Wash, the principal stream in Hualapai Valley) are ephemeral.



Source: Electrical conductivity of sediments conducted at the sample site by Russel Barmore, USDA, and Cary Secrest, FERC, on April 24, 1981.

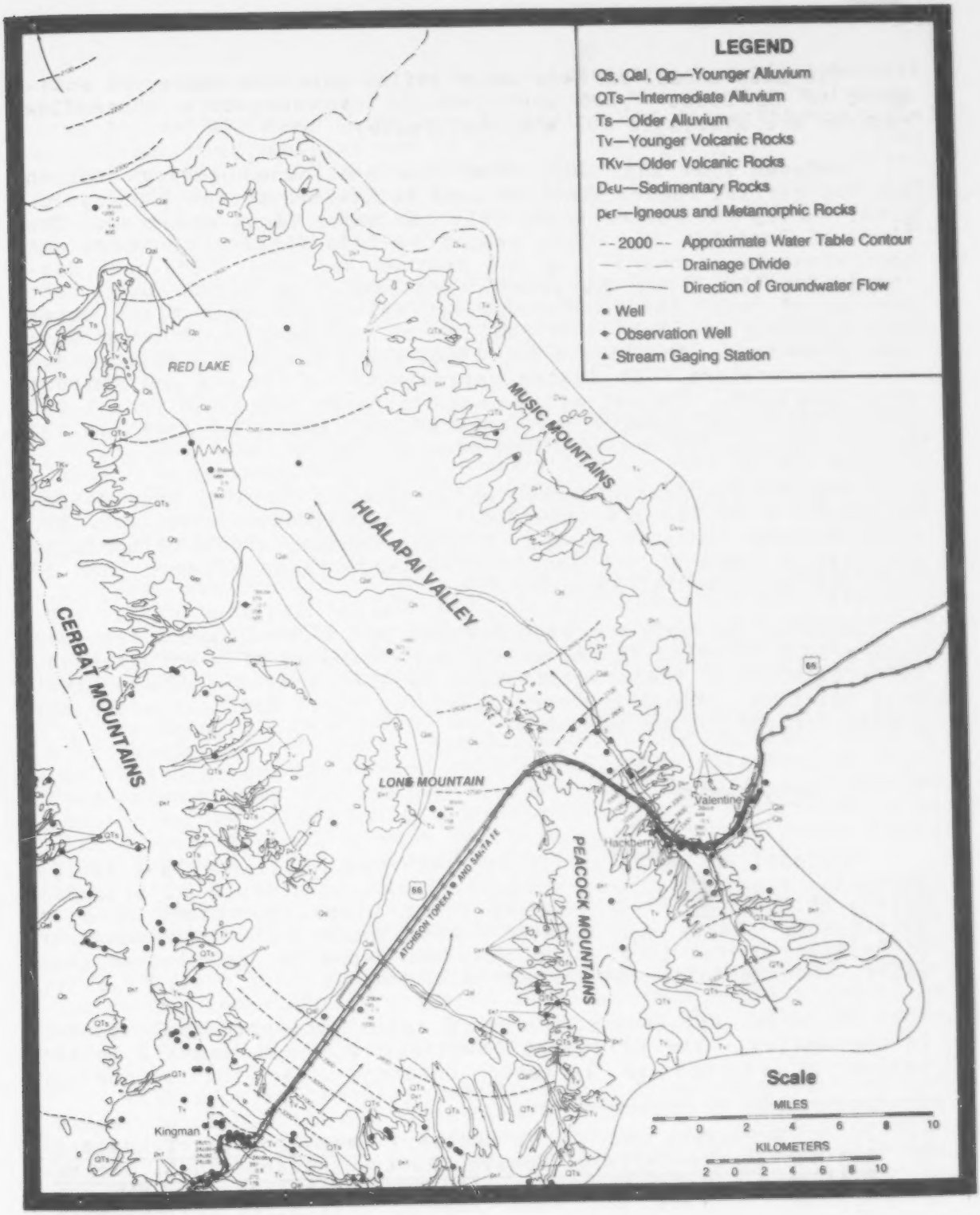
Figure 21

Approximate Electrical Conductivity of Red Lake Playa Sediments



Adapted from: Lower Colorado Region State-Federal Interagency Group for the Pacific Southwest Interagency Committee, *Lower Colorado Region Comprehensive Framework Study Main Report* (1971), p. ii.

Figure 22
Lower Colorado Hydrologic Region



Modified from Gillespie and Bentley, plate 1.

Figure 23

Selected Wells and Water Level Contours in Hualapai Valley

The mean annual surface water inflow into the valley is estimated to be about 4,000 acre feet.[1/] No long-term streamflow records are available for Hualapai Valley.

Between 1964 and 1967, when one continuous gaging station and two partial record stations were maintained by the U.S. Geological Survey on Truxton Wash, only two major flows occurred. The flood of December 10, 1965, caused by rain falling on snow, was approximately 36 hours long and reached Red Lake. The peak discharge for the flood decreased downstream from 1,120 cubic feet per second (cfs) in Truxton Wash at Valentine (peak flood stage approximately 2.8 feet) to 520 cfs at the gage in Truxton Wash near Hackberry. The August 18, 1966, flood followed a high intensity thunderstorm. It lasted approximately 12 hours and did not reach Red Lake. The estimated peak discharge decreased from 1,960 cfs at Valentine (peak flood stage approximately 3.5 feet) to 402 cfs at the gage at Truxton Wash near Hackberry.

The maximum peak observed was on August 2, 1904, when a flow estimated at 49,000 cfs occurred in Truxton Canyon. On July 30, 1904, however, Truxton Wash in Truxton Canyon, which is normally dry, had a depth at one Santa Fe Railway bridge of more than 30 feet and "a very high velocity."[2/]

Whether streamflows reach Red Lake and to what extent flooding occurs is a function of the amount and intensity of precipitation, the proximity of the precipitation to the lake, and the ambient soil moisture. Flows are more likely to flood Red Lake after extended periods of wet weather.

2. Groundwater

Hualapai Valley is an intermontane basin filled with alluvial deposits, evaporites, and volcanic rocks to a depth of approximately 10,000 feet. The valley floor slopes northward from an altitude of nearly 4,000 feet at the south to an elevation of 2,754 feet at Red Lake. The alluvial deposits are divided into older, intermediate, and younger alluvium.

The older alluvium of Tertiary age is the principal aquifer in the valley. The unit, the lowermost alluvial deposit in the valley, is exposed in isolated outcrops near the mountains.

1/ J. B. Gillespie and C. B. Bentley, Geohydrology of Hualapai and Sacramento Valleys, Mohave County, Arizona: U.S. Geological Survey Water-Supply Paper 1899-H (Washington, 1971), p. 21.

2/ E. C. Murphy, Destructive Floods in the United States in 1904: U.S. Geological Survey Water Supply Paper 147 (Washington, D.C., 1905), p. 115.

The intermediate alluvium is an extensive near-surface deposit lying above the older alluvium and under the younger alluvium. From 200 to 500 feet thick, it is exposed in discontinuous outcrops near the mountains and in small isolated patches in canyons in the mountains. While the intermediate alluvium is not an important aquifer because most of it lies above the water table in the project area, it is capable of transmitting large quantities of groundwater in other areas.

The younger alluvium covers extensive areas in Hualapai Valley. It is generally above the water table except in some of the mountain canyons, where the stream deposits yield small amounts of water to wells. Tertiary volcanic rocks are an aquifer near Kingman.

Numerous springs discharge in the mountains and hills throughout the Hualapai Valley groundwater basin. Most of the springs issue from igneous, metamorphic, and volcanic rocks in the mountain areas. No springs are known to issue from the alluvium on the valley floor. According to Gillespie and Bentley, the median spring discharge is about 2 gpm.

According to a U.S. Geological Survey seismic refraction survey across Hualapai Valley north of Red Lake, alluvial deposits above the water table are about 620 feet thick. The base of the alluvium is about 3,000 feet deep. Depth to water is about 500 to 900 feet northeast of Kingman and about 300 feet south of Red Lake.

Recharge to the alluvial deposits, primarily from infiltration of streamflow, is primarily associated with Truxton Wash. Much of the recharge also occurs near the apexes of the dissected alluvial fans which extend into the mountain canyons. Recharge from precipitation on the valley floor is negligible because of the generally high evapotranspiration rate and because of the relatively impervious layers of clay and caliche near the land surface.

Gillespie and Bentley estimate groundwater recharge in the Hualapai basin to be 5,000 acre feet annually. This value is based on an estimated annual subsurface outflow from the Hualapai basin of 5,000 acre feet and the assumption that, under natural conditions, the long-term groundwater recharge in a basin is equal to the groundwater discharge. Total storage in the valley is estimated to be 10.5 to 21 million acre feet.

Gillespie and Bentley estimate that 1,000 acre feet of the annual outflow flows out of the basin southeast of Hackberry. The remainder moves generally northward through the valley. Groundwater flow from the southern part of the Hualapai groundwater basin may be redirected northeastward and/or northwestward by fine-grained materials beneath Red Lake and in nearby areas that act as a barrier. In a recent report on groundwater conditions in Hualapai Valley, W. H. Remick estimates that the outflow north is from 2,000 to 2,500 acre feet annually and that the

southeast outflow is from 400 to 1,300 acre feet annually.[1/] On the basis of a 1936 report of a large spring near the mouth of Hualapai Wash, now submerged by Lake Mead, R. L. Laney suggests that discharge to the north is by underflow into Lake Mead.[2/] The currently available geologic data indicate that the aquifer is semiconfined by the thick clay deposits and under artesian pressure in the vicinity of the proposed project. This clay, originally deposited in a now extinct lake, thickens to the east side of Truxton Wash and is complexly interbedded with coarser deposits of the adjacent alluvial fans and pediments.

Table 7 presents information about water quality and some aquifer parameters for selected wells in Hackberry, Kingman, and Hualapai Valley. Most of these wells are shown on figures 23 and 24. Groundwater generally is of good quality for most uses. In some instances, however, fluoride and total dissolved solids concentrations exceed acceptable levels. Figure 25 shows the hydrogeologic conditions in the vicinity of the proposed facility.

Fluoride concentrations in samples from wells and springs in the Hualapai basin range from 0 to 6.5 milligrams per liter (mg/l). Drinking water regulations for the State of Arizona allow a maximum contaminant level for fluoride in the area of 1.6 mg/l. About one-third of the samples analyzed had fluoride concentrations which exceeded this level.

The maximum contaminant level allowed for dissolved solids proposed in EPA's secondary drinking water regulations is 500 mg/l. The few wells or springs which have dissolved solid concentrations that exceed this level are usually near the edge of the older alluvium or within the fractured or weathered crystalline rocks or the thin patches of alluvium in the mountains. One significant exception is a well south of Red Lake. (See well [B-26-16] 29 bbb in table 7.) The water sample taken from that well had a dissolved solids concentration of 9,600 mg/l. Remick attributes this high concentration to the presence of shallow evaporites, common in the Basin and Range physiographic province, which might have been encountered by the well. Because of the absence of test wells on the southeastern side of the valley, the quality of water and the extent of the shallow evaporites are unknown. Bentley and Gillespie indicate that the change of groundwater from the sodium-calcium bicarbonate type to the sodium chloride type through the valley can also be attributed to evaporite deposits.

Water pumped from the Hualapai Valley groundwater basin has increased from 20 acre feet per year before 1960 to 6,000 acre feet annually in 1980. The Hackberry well field, used as a

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1/ Map Showing Ground-Water Conditions in the Hualapai Basin Area: Mohave, Coconino, and Yavapai Counties, Arizona--1980, D.W.R. Hydrologic Map Series Report No. 4.

2/ Ibid.

TABLE 7

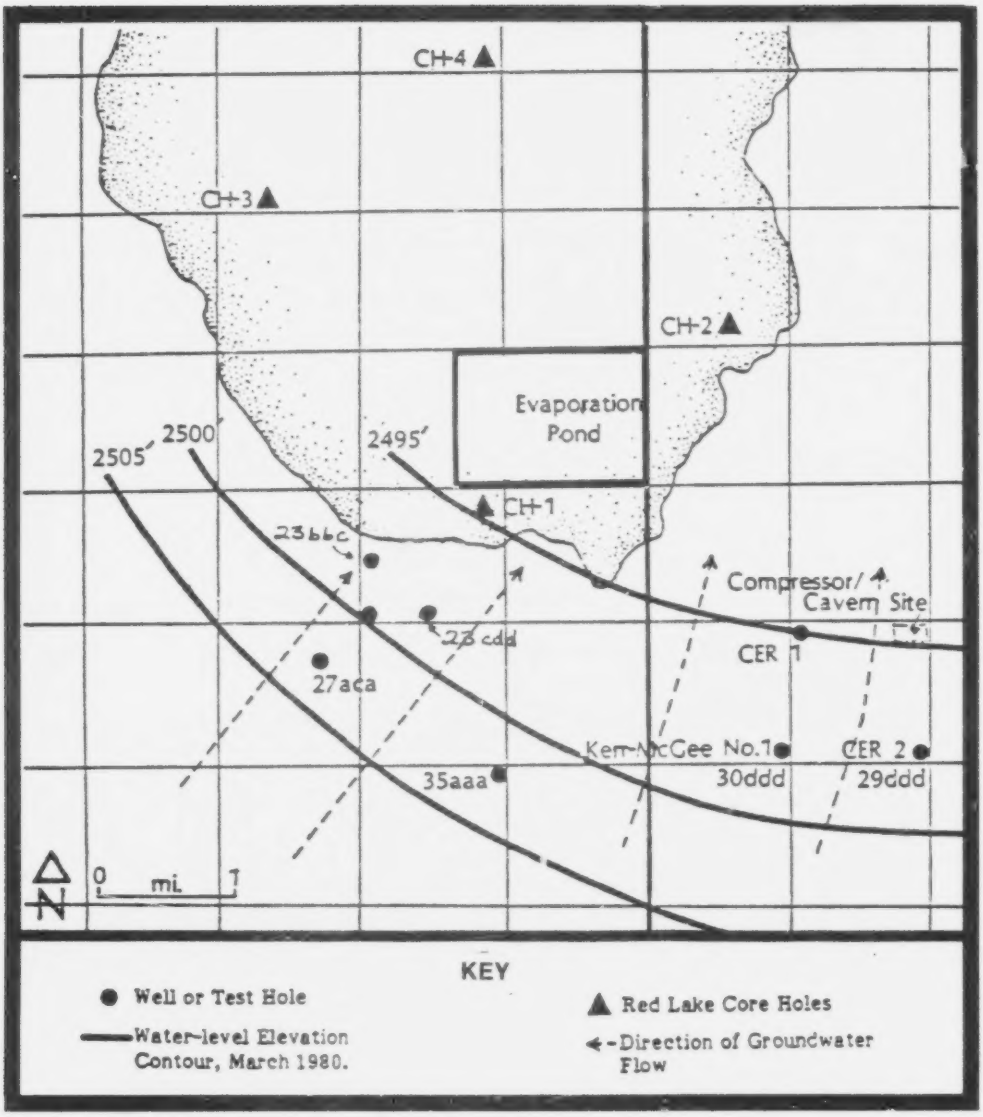
SUMMARY OF AQUIFER AND WATER QUALITY DATA

Well	Depth (Feet)	Permeable Material (Feet Below Ground Level)	Depth to Water (Feet)	Aquifer Test Data						Water Quality Data											
				Test Date	Well Discharge Rate (Gpm)	Well Drawdown (Feet)	Specific Capacity (Gpm per Foot of Drawdown	Transmissivity (Gallons per Day/Foot)	Storativity	Calcium (Mg/l)	Magnesium (Mg/l)	Sodium (Mg/l)	Potassium (Mg/l)	Carbonate (Mg/l)	Bicarbonate (Mg/l)	Sulfate (Mg/l)	Chloride (Mg/l)	Fluoride (Mg/l)	pH	Conductivity Micromhos at 25°C	Total Dissolved Solids (Mg/l)
*(B-21-17) 24 cda	178		120	1962	105	44	2.4			66	25	25 Combined				31	48	0.8			391
*(B-22-16) 26 bac	1,230		530	2/10/67	660	51	12.9	44,000		16	14	32 Combined		0	16.4	13	11	1.7	7.7	324	195
*(B-23-13) 20 ccd	355		129	11/10/64	580	80	7.2	22,000		50	33	45 Combined		18	228	39	58	0.5		676	444
*(B-23-15) 8 ddd	929			3/5/65						48	9	53 Combined		0	132	45	57	1.7			344
*(B-24-16) 1 ddd				2/15/67						30	24	49 Combined		0	164	34	75	1.8	7.8	573	325
*(B-25-16) 30 cda	600			3/9/67						35	29	58 Combined		0	240	51	59	0.9	7.9	629	379
(B-26-16) 28 ddc Kermac #2	2,135	100-150			240	100	2.4	2,100													
**(B-26-16) 25 bbb CER #1	650	0-250 Some		12/18/79								6,000					16,346			16,000	9,600
**(B-26-16) 29 ddd CER #2	710	260-270 370-400		1/11/80						1,102	1,177		19.3		51	1,845					
**(B-26-16) 30 ddd Kermac #1	2,608	100-160 300-320 820-840																			
**(B-26-17) 23 ccc Neal #1	719	0-200 400-719	262	4/10/81	1,500	63	24	172,000	0.00076	2	1	72					28		9.1		218
(B-26-17) 23 - cdd 2,200 feet due east of Neal #1/CER #3	750	500-750		4/10/81	2,000	125		17,440	0.00073								517 Nacl				698
**(B-26-17) 23 - bbc CER #4	650	300-650	273	7/16/81	1,750			237,600	0.00083												
**(B-26-17) 27 aca	613	0-613																			
*(B-26-17) 35 aaa **	800	0-60 500-700	266	3/9/67	1,500	134	11.2	34,000		25	3	234			72	17	355	2.6	7.8	1,320	688
(B-27-17) 29 ccc North of Red Lake				1/66						7	6	289		56	509	25	90	3.0	8.7	1,270	727
(B-28-17) 31 ccc	800			6/10/65						3.6	1.2	460 Combined		41	120	95	528	1.2	9.5	2,210	1,200

* Shown on figure 23.

** Shown on figure 25.

a/ Well was screened from 250 feet to total depth. Screened intervals in other wells are unknown.



Source: Southwest, *Red Lake, Arizona, Gas Storage Facility Information* (Las Vegas, February 1979), p. 67.

Figure 24
Water Level Elevation Contours

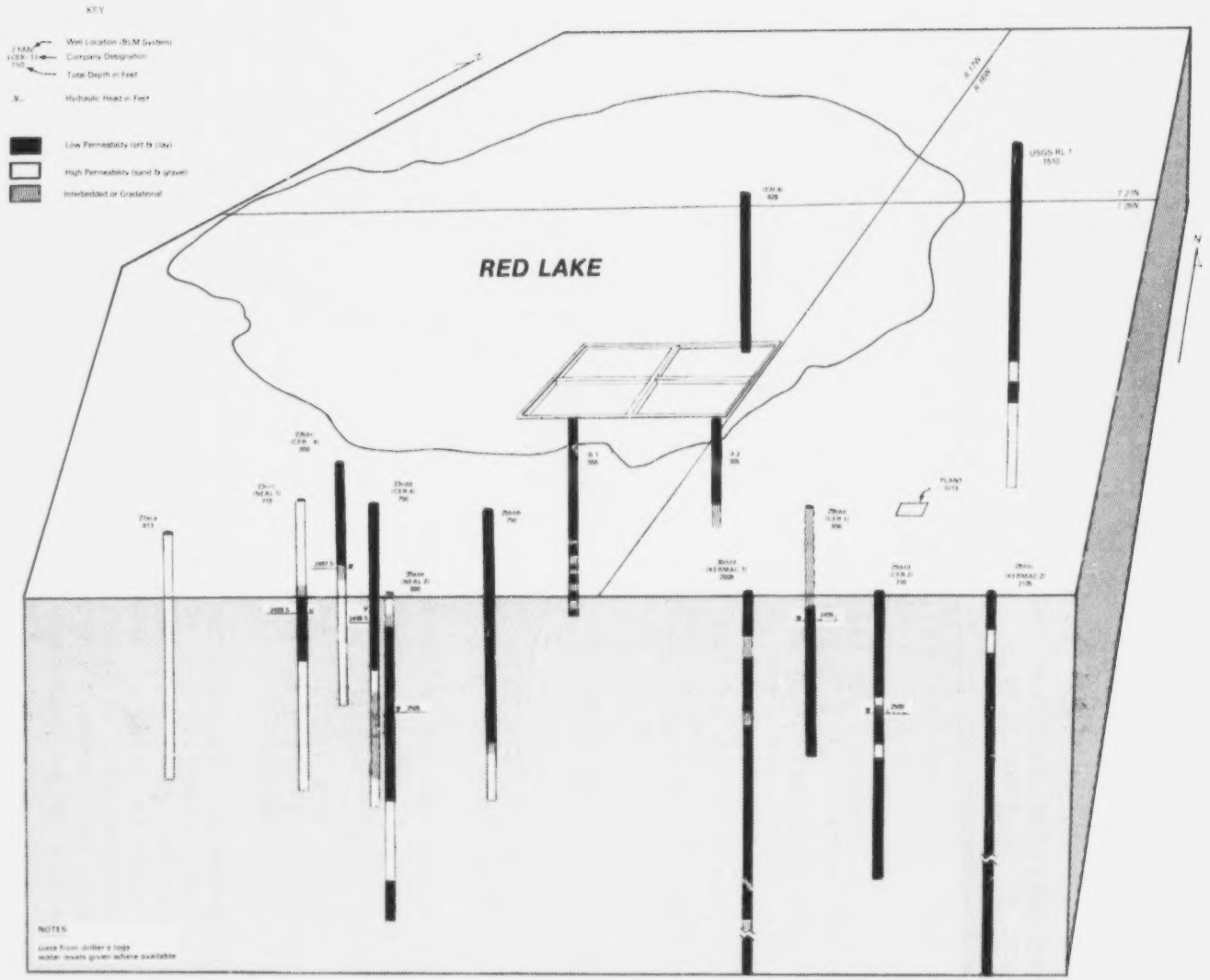


Figure 25
Block Diagram of Project Area with Hydrogeologic Data

municipal water supply for Kingman, began operation in 1960. By 1965, extensive pumping from this field was causing an annual decline of the static water level ranging from 5 to 7 feet, and pumping was reduced to approximately 50 percent. After 1969, the Hackberry well field was discontinued as a municipal supply. Kingman, approximately 30 miles upgradient from the proposed project area, is currently the only major user of groundwater in the valley.

Hydrographs of water levels for two currently unused wells in the Hackberry Field and a currently unused well in Truxton Wash northwest of Hackberry depict the decline in water levels because of pumping. In all three wells, water levels declined approximately 50 feet between 1940 and 1980. In the shallowest (original inferred depth to water 51 feet), the water level began to increase in 1978 and in 1980 was within approximately 15 feet of the original level. In the well of intermediate depth (original inferred depth to water approximately 200 feet), the decline stopped and the level stabilized in 1970 at a depth of approximately 250 feet. In the deepest well (original inferred depth to water approximately 500 feet), the water level was still declining in 1980 at a depth of approximately 540 feet. Two other wells in the main part of the Hualapai Valley south of Red Lake have been pumped for a minimum of 15 years at an unknown rate from depths of 260 feet and 450 feet; neither show a decline in water levels.

F. BIOLOGICAL RESOURCES

1. Vegetation and Wildlife

Vegetation at the proposed storage site and along the proposed pipeline route includes five distinct plant communities--shadscale, saltbush, desert grassland, shrub-grass disclimax, and Mohave thorn. Their general locations and a list of representative species are identified in table 8. The Red Lake playa is essentially unvegetated because of seasonal flooding, soil compaction, and soil salinity.

The temporary access road connecting the plant site to Stockton Hill Road would cross about 4.5 miles of shadscale and 1.2 miles of shrub-grass disclimax. A permanent access road connecting the plant site to Antares Road, about 5 miles to the east, would also be constructed. A detailed vegetation survey of that route has not been performed, but a BLM vegetation map indicates that the road would cross saltbush and a small amount of desert grassland.

TABLE 8

PLANT COMMUNITIES IN PROPOSED PROJECT AREA

Community	Representative Species	Approximate Location a/
Shadscale	Shadscale, four winged saltbush, galleta, fluff grass	Vicinity of cavern/ compressor site to mile-post (MP) 1
Saltbush	Four-winged saltbush, galleta, Anderson thorn-bush	MP 1-MP 11.8
Desert Grassland	Galleta, black grama grass, fluff grass, desert trumpet, banana yucca	MP 11.8-MP 28.5
Shrub-grass Disclimax	Snakeweed, black grama grass, desert trumpet, fluff grass, banana yucca	MP 28.5-MP 29.8
Mohave Thorn	California buckwheat, black grama grass, snakeweed, Mohave thorn	MP 29.8-MP 30.4

a/ Mileposts starting at storage site.

The extent of plant cover and species diversity in most of the plant communities has been significantly affected by cattle grazing. Generally, intensive grazing in the valley reduces common grasses so that less palatable shrub species develop. Off-road vehicles using the area may also contribute to vegetation changes.

Hualapai Valley lacks the faunal diversity found in the surrounding foothills and mountains. Desert bighorn sheep are absent, while only small numbers of mule deer and pronghorn occur in the project area. Small herds of pronghorn have been reported about 5 miles southeast of Red Lake, but it is uncertain whether these animals are transients or permanent residents of the valley. Historically, large herds of pronghorn occurred throughout the valley. According to the Proposed Livestock Grazing Program: Cerbat/Black Mountain Planning Unit; Final Environmental Impact Statement, published by BLM in 1978, most of Hualapai Valley is designated as a pronghorn establishment area.

Small rodents, desert cottontails, and black-tailed jackrabbits are common throughout Hualapai Valley. The relative abundance of Merriam's kangaroo rats is typical of overgrazed range where shrubs dominate the vegetation. The usual mix of desert birdlife occurs in the area. Some of the more common species include the Gambels' quail, horned lark, cactus wren, verdin, and sage sparrow.

As would be expected in this environment, waterfowl and shorebird use of the project area is very limited. The Hualapai Valley is not within a major migratory flyway; however, small numbers of these birds are occasionally seen on ponds and on Red Lake when periods of heavy rainfall coincide with migration.

Predators are a prominent component of the local fauna. Coyotes, kit foxes, and various species of raptors are commonly observed in the area. Because of the scarcity of nesting sites, raptors primarily use the area as a hunting ground. However, burrowing owl nesting has been noted near the southern terminus of the proposed pipeline route, and an active ferruginous hawk nest is located in Truxton Wash, south of Red Lake.

Reptile diversity in the arid environment is typically high, and amphibians are limited in species and abundance. Thirty-nine species of reptiles occur in the valley and surrounding mountains. They are widely distributed, with some species occurring in virtually every vegetation type.

A detailed description of the vegetation and wildlife occurring in Hualapai Valley and surrounding mountains appears in BLM's Proposed Livestock Grazing Program, incorporated by reference.

2. Endangered and Threatened Species

In compliance with section 7 of the Endangered Species Act of 1973, as amended, the FERC staff requested that the U.S. Fish and Wildlife Service (FWS) provide a list of federally listed or proposed endangered or threatened species which could be present in the proposed project area. In its April 23, 1981, letter to the FERC staff, the FWS indicated that no listed or proposed endangered or threatened species would be affected by the Pataya storage project. (See appendix D.)

The zone-tailed hawk and the desert tortoise, both listed as threatened or sensitive by the State of Arizona, may occur in the project area. The zone-tail hawk hunts for rodents, birds, and reptiles throughout the valley, but it does not nest near the cavern site or along the pipeline route. The desert tortoise also occurs throughout the valley, but at very low densities. Tortoises in the valley would most likely be found in areas containing rocky slopes or outcrops.

Two plant taxa currently under review by the FWS for possible listing as endangered or threatened--Astragulus lentigniosus var. ambiguus and A. titanophilus--could occur near the plant site or along the pipeline route. A third taxa under review, Opuntia phaecantha ssp. superbospina, occurs near the southern end of the pipeline route. Until listed by the FWS, these plant taxa are not protected by the Endangered Species Act. However, Opuntia phaecantha ssp. superbospina is protected by the Arizona Native Plant Law, which protects all cacti species in the state.

G. LAND USE, RECREATION, AND AESTHETICS

1. Land Use

White men settled in Hualapai Valley in the 1860's, when the first ranchers raised a few cattle to feed the cavalry, miners, and friendly Indians. In 1882, the Atchison-Topeka and Santa Fe Railroad was completed. Crossing the valley, it provided transportation for livestock, thereby opening the valley to more intensive grazing.

Grazing continues to be the principal use of land today, although ranching employs less than 2 percent of the local labor force. The inherently low level of forage growth, coupled with

past overgrazing, makes vast ranches necessary.[1] The average ranch in the region is operated by a single family and encompasses 120 square miles. Because a ranch typically supports only 220 head of cattle, most ranchers supplement their income with outside employment.[2]

Most ranchers own no more than half of the land they use. The other half is owned by the Federal Government and managed by the the BLM. In most of the valley, the ownership pattern, shown in figure 26, resembles a checkerboard of square-mile blocks. This gives BLM partial control over private land because it is difficult to use private land without crossing adjacent Federal land. As principal land planner and administrator in the valley, BLM controls livestock grazing, rangeland improvements, and other public uses of the land.[3] Ranchers apply to BLM for grazing rights on public land. The area they apply for is called an allotment, which generally includes the rancher's private land. BLM administration has resulted in disputes with ranchers. The most recent began in 1978 when BLM proposed to reduce livestock grazing an average of 21 percent to improve range quality. Before 1973, BLM did not control livestock grazing levels.

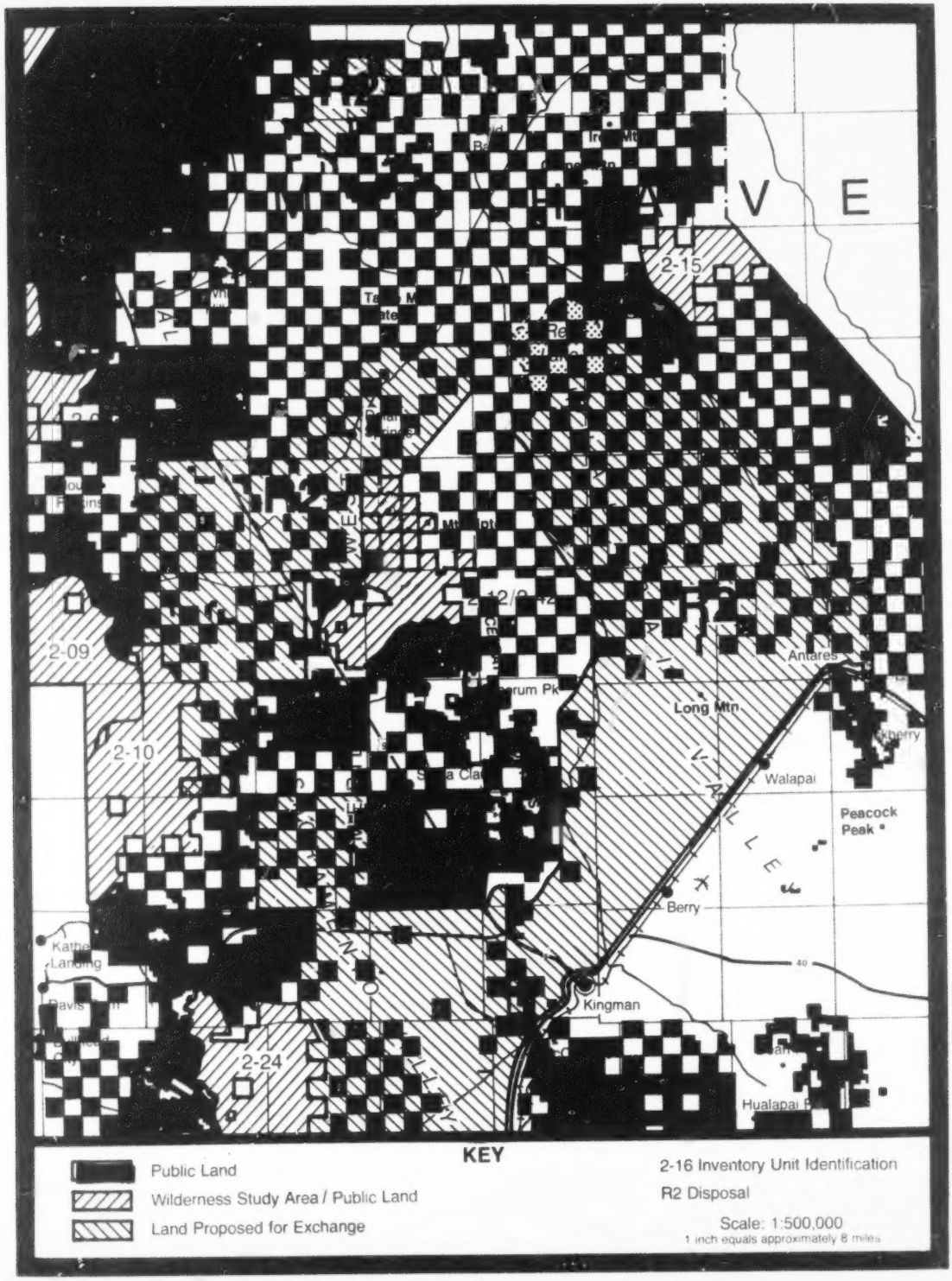
To reduce this kind of conflict and to increase the usefulness of public lands, BLM plans to consolidate the checkerboard pattern of public and private land by exchanging public land in areas where little public benefit exists for private land where the public benefit is greater. All public land in the project area is currently planned by the BLM to be exchanged for private land, converting much of Hualapai Valley to private ownership. The exchange areas are shown in figure 26. However, land exchanges must be initiated by the private landowner.

The construction of homes in the valley has been hindered by the lack of power and water. Although subdivided land abounds throughout the valley, there are virtually no houses between the northern suburbs of Kingman and Red Lake. This contrasts sharply with the Sacramento Valley to the west, which has hundreds of trailer homes.

1/ Ranchers contend the range is in the same condition it was a hundred years ago. A recent study by BLM (Proposed Livestock Grazing Program) concludes otherwise.

2/ This average is derived from 23 ranches surrounding the project site in the BLM Cerbat/Black Mountain Planning Units of the Kingman Resource Area. Ranches actually vary widely in size and stocking rate.

3/ Mohave County also plans land use through land zoning. However, county zoning is subordinate to BLM management where Federal land is involved. Previously zoned agricultural-residential, the project site is now zoned for unlimited industrial use.



Adapted from: BLM, Wilderness Study Areas (November 1980)

Figure 26
Land Ownership Pattern in Hualapai Valley

Red Lake and the surrounding environs were the subject of a 1973 study by the Arizona Department of Economic Planning and Development to determine if they should be retained as a natural area. Under this designation, Red Lake would be preserved for the study of dry lake beds and their associated plants and animals. The study found that while Red Lake has high scientific value, it would not be feasible for the state to acquire the land. Thus, the state has taken no action to establsh a study area.

The BLM is investigating two other natural areas near Red Lake for possible wilderness designation. This would influence future uses of the areas. Designated WSA 2-15 and WSA 2-12/2-42, these areas are visible from the project site, but they would not be crossed by the proposed facilities. (Figure 26 shows these areas.)

The Santa Fe Railroad holds the mineral rights to the salt deposit Pataya proposes to use for the gas storage caverns. No other mineral rights would be affected by the project.

In October 1979, the Carson Water Company (CWC), a wholly owned subsidiary of Southwest, purchased most of the Cane Springs Ranch, shown in figure 27. The company owns about 30,000 acres of ranch; the remaining 42,000 acres are owned by the state and Federal Governments. A small portion of the private land is also owned by Mayland Properties, Incorporated. There is one ranch house on the ranch.

Pataya proposes to use 1,600 acres of the ranch for the gas storage facility and brine evaporation ponds. CWC owns 960 acres of the project site; CWC has proposed to exchange its land on Mt. Tipton for Federal land surrounding the gas storage site, shown in figure 28. Mayland Properties Inc., which owns 600 acres of the site, refuses to sell its land to Pataya for the price offered. The remaining 40 acres are owned by an unknown private party. A large part of the evapertion pond would be located on the land owned by Mayland Propeties, Inc. and the unknown party.

The Cane Springs Ranch has been used principally for grazing, although grazing was discontinued in June 1981. CWC has a tentative arrangement with the University of Arizona to allow the University to conduct grazing studies on the ranch in 1 or 2 years. According to Dr. Lemar Smith, these studies would focus on experimental range management, revegetation, and other experiments related to range improvement. CWC also discussed with the university the possibility of experimenting with the brine evaporation ponds to produce electricity. No formal arrangements have been made for either of these studies.

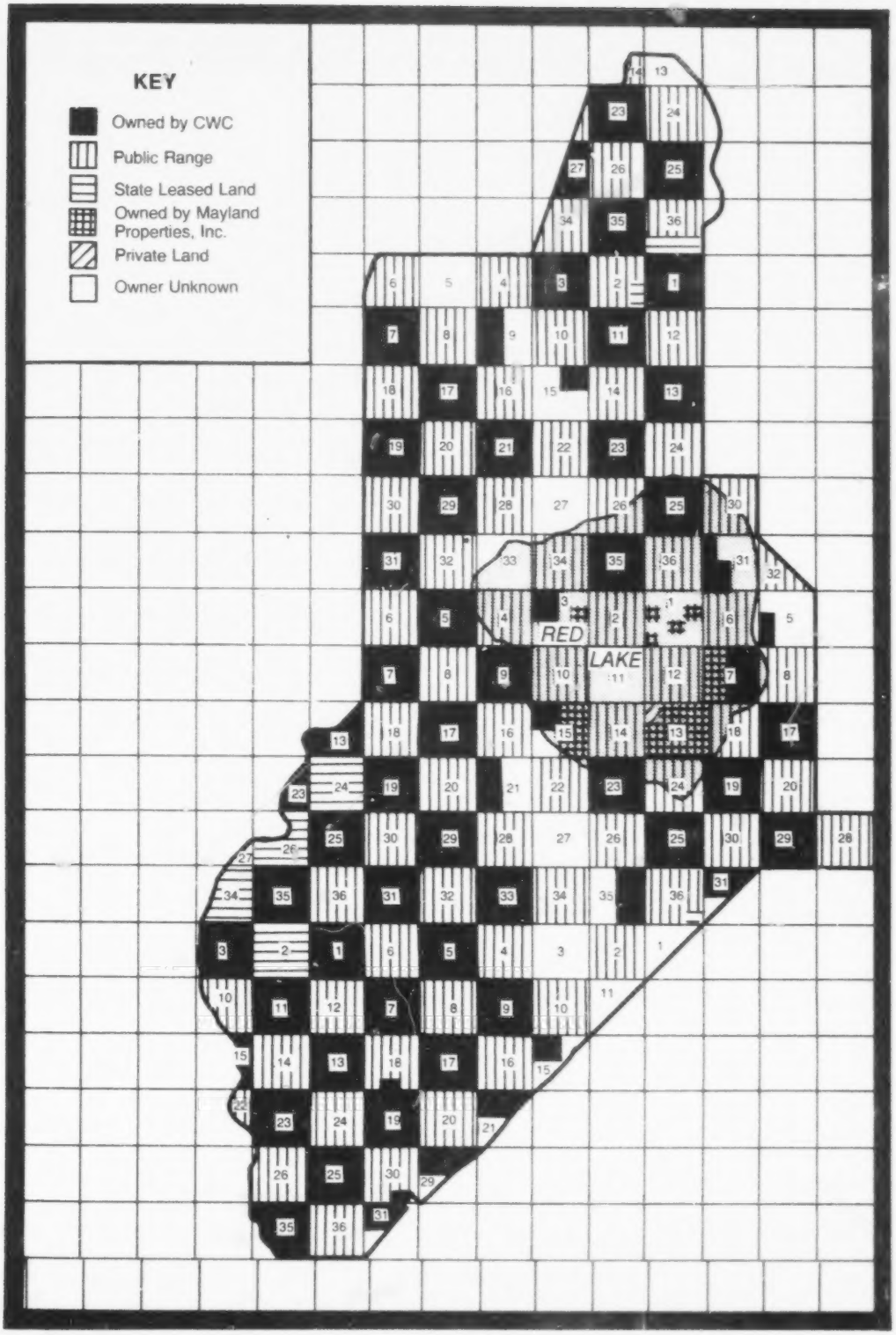
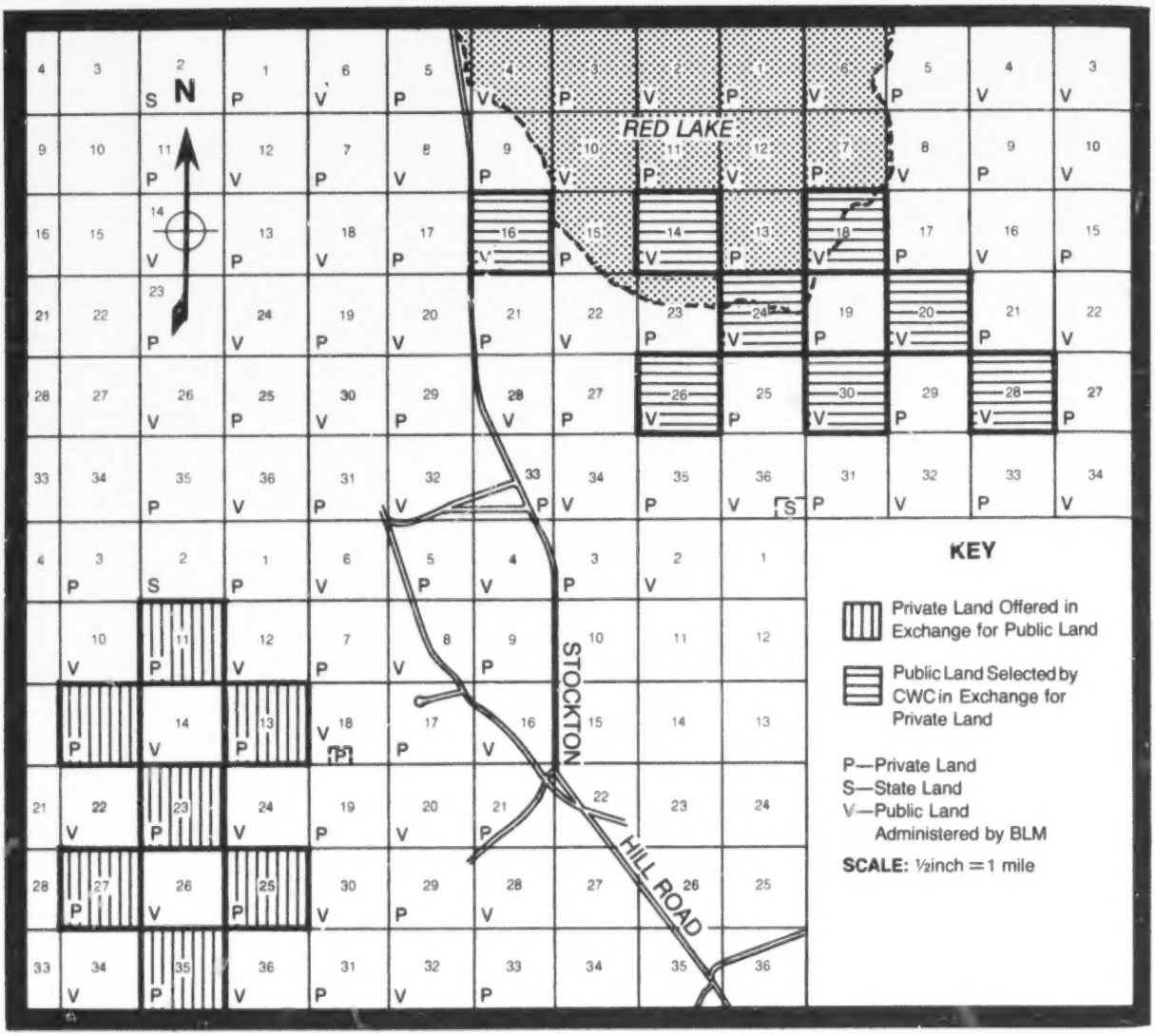


Figure 27
Ownership of Cane Springs Ranch (Project Area)



Source: Roger Taylor, BLM Kingman Resource Area, letter to Lonnie Lister, FERC, March 10, 1981.

Figure 28
Proposed Land Exchange on Project Site

2. Recreation

In 1975, the BLM analyzed recreation in the Cerbat Mountain Planning Unit, which includes the Hualapai Valley, the Cerbat Mountains to the west, and the Grand Wash Cliffs to the east. Unlike the neighboring Black Mountain Planning Unit to the west, sightseeing exceeded hunting in total visitor use, followed by rock collecting, off-road vehicle driving, camping, and picnicking. These activities, itemized in table 9, occur primarily in the mountains.

Recently, the North American Landsailing Association (NALSA) expressed an interest in using Red Lake for landsailing. (A landsailing vehicle is a long, low, three-wheeled craft with a sail.) NALSA believes that Red Lake is particularly suited to landsailing because of its nearly constant wind, large size, and unobstructed surface. To implement this plan, NALSA suggested that Southwest exchange its private land on the northern half of Red Lake for BLM land elsewhere. Such an exchange would consolidate public ownership of the northern half of Red Lake and thus make it available to the landsailers. Both Southwest and BLM denied the NALSA request. Southwest denied it because of fears that landsailers would interfere with grazing on the Cane Springs Ranch; BLM denied it because the agency cannot propose land exchanges with private landowners.

3. Aesthetics

The project area has a high aesthetic value for those who appreciate desert landscapes, which may account for the extensive sightseeing in the valley. Important to its aesthetic quality is the lack of artificial features. Although a high-voltage powerline traverses the valley along the footslopes of the mountains on the east and a road traverses each side, these features do not stand out in the landscape. Unlike the neighboring Sacramento Valley, there are virtually no dwellings north of the suburbs of Kingman. Figure 29 shows the landscape near the project area.

Under BLM's visual management system, the valley is rated Class III and IV. In Class III areas, changes in the basic elements caused by a management activity may be evident in the characteristic landscape, but the changes should remain subordinate to the visual strength of the existing character. In Class IV areas, changes may subordinate the original composition and character but must reflect what could be a natural occurrence within the characteristic landscape.

TABLE 9

RECREATIONAL USE OF CERBAT/BLACK MOUNTAIN PLANNING UNITS

Planning Unit	Activity	Primary Season of Use	Total Visitor Days Per Year
Cerbat Mountains	Sightseeing	Year-round	6,762
	Hunting	Hunting Season	5,810
	Rock Hounding	Fall, spring	677
	Off-road Vehicle Use	Winter, spring	932
	Camping and Picnicking	Fall, spring	823
		Total	15,004
Black Mountains	Sightseeing	Year-round	1,666
	Hunting	Hunting Season	2,434
	Rock Hounding	Winter	378
	Off-road Vehicle Use	Winter, spring	223
	Other	Year-round	679
		Total	5,380

Source: Proposed Livestock Grazing Program, p. II-100.

Looking east across Hualapai Valley from Stockton Hill Road, between Red Lake and Kingman.

Looking east across Red Lake (middle ground) from Stockton Hill Road

Figure 29
Landscape Near Project Area

H. SOCIOECONOMICS

Mohave County has long been characterized by two developments of the latter half of the 19th century: mining and ranching. The discovery of gold and silver in the mid-1850's brought the mines and the boomtowns. Many of these mines were forced out of production by fixed gold prices imposed during the 1930's, but in recent years, copper and turquoise mining have become significant industries.

Cattlemen arriving in the 1870's established an industry significant enough to attract a transcontinental railroad through the county and to establish Kingman as a shipping center in the early 1880's, when it was founded by Lewis Kingman.

Construction of the Hoover Dam at the northwestern bend of the Colorado River and of the Davis and Parker Dams farther south created Lake Mead, Lake Mohave, and Lake Havasu, giving Mohave County 1,000 miles of freshwater shoreline and altering its economic and social profile. Unlike the earlier "rugged individuals," more recent immigrants are primarily urban or suburban dwellers leaving the city and its abundance of services and problems to seek a rural setting, healthful climate, and outdoor recreational opportunities. They have brought with them service industries, tourism, and recreation and have altered the composition of the population.

In December 1979, Mountain West Research Inc. completed a survey of the nonreservation area in Mohave County south of the Colorado River. This Mohave County Study Area was divided into three major labor-market areas (LMA's): the Kingman LMA, the Lake Havasu City LMA, and the Mohave Valley LMA. The population of the Mohave County Study Area at the time of the survey was estimated to be 47,195, more than 90 percent of the estimated total population of the county. This figure reflects an approximate increase in population of 99 percent since 1970, representing an annual growth rate of 8 percent between 1970 and 1979. This figure was the highest growth rate in Arizona for that period. The Kingman LMA was estimated to have about 15,270 people, 32 percent of the total county study area population. According to the 1980 census, the city of Kingman has 3,857 housing units and a population of 9,246. The preliminary 1980 census count of Mohave County now stands at 55,500 persons.

The median age in the county study area was estimated to be 44, significantly higher than the 1976 U.S. median age of 29. The population of the study area was predominately Anglo-American (95.2 percent), with lower than state-average populations of Native Americans, Mexican-Americans, and blacks.

TABLE 10

MOHAVE COUNTY EMPLOYMENT STRUCTURE

Employment Sector	Percent of Total
Public Administration	22.4
Wholesale and Retail Trade	22.2
Services	17.0
Manufacturing	15.7
Construction	8.3
Transportation, Commmunication, and Public Utilities	5.4
Mining	3.7
Finance, Insurance, and Real Estate	3.5
Agriculture	1.7

Source: Arizona Office of Economic Planning and Development, Kingman, Arizona, Community Profile (Phoenix, 1979), December 1979), p. 1.

The median family income of the study area was estimated to be between $10,000 and $15,000, less than the estimated U.S. median of $14,600. This is the result of the significant number of retired people who reside in the area and the importance of lower waged service and trade industries to the county's economy.

More than 67 percent of the adult residents had attained educational levels of high school or more. However, less than 11 percent of the population over 25 had completed 4 years of college. This compares to a 1976 national average of 14.7 percent and to a 1970 Arizona figure of 12.6 percent.

Nearly 50 percent of the survey respondents reported that they had moved to the area within the past 5 years; 14 percent said they had moved within the past year. Eighty-four percent of the recent migrants came from outside the state. The majority of them came because of the climate, life style, or other amenities.

The economy of Mohave County depends heavily upon tourist-related activities. Trade and service industries accounted for over 39 percent of the total jobs in Mohave County. (Table 10 identifies employment distribution for the county.) Government--particularly county administration and Mohave Community College staff--employed 22.4 percent of the total work force, followed by manufacturing with 15.4 percent. Other industrial sectors that employed significant numbers of workers in Mohave County included construction and transportation, communication, and public utilities (primarily railroad employment).

Total personal income in Mohave County is expected to increase from $150 million in 1976 to $289 million in 1990, or by 93 percent over 14 years. The 1979 unemployment rate in the Kingman area was estimated to be 6.8 percent. The highest percentage of low-paying jobs was in the trade and service sectors. Of the higher wage jobs, most were in the transportation, communication, and public utility sectors in the Kingman area.

I. NOISE QUALITY

To describe a noise environment and to assess potential impact upon noise-sensitive areas, a frequency weighting measure which stimulates human perceptions is customarily selected. A-weighted ratings of noise sources, which reflect the human ear's reduced sensitivity to low frequencies, correlate well with the human perception of noise. Consequently, A-weighted noise levels, described in decibels, are the values cited most in noise assessments. Decibels are logarithmic units that compare the wide range of sound intensitites to which the human ear is sensitive.

Sound levels are represented as an L_{eq}--sound energy averaged over 24 hours--or an L_{dn}--the L_{eq} with a 10-dB(A) weighting applied to nighttime sound levels (10 p.m. to 7 a.m.). The L_{eq} is an equivalent A-weighted sound level, while the L_{dn} is a day-night sound level.

The proposed storage facility and pipeline would be constructed in rural areas of low population density, although some residential, commercial, and industrial development does exist along the proposed pipeline route. Noise levels on the outskirts of Kingman range between 40 to 50 dB(A). The ambient noise levels in the project area and along the proposed pipeline route typically range from 35 to 40 dB(A). Pataya has not surveyed noise levels near the proposed compressor station at the Red Lake site. However, noise levels within the area of the proposed project can be estimated using the relationship between land use patterns and the resulting community noise levels. The following estimates of typical background noise levels are based on population density and land use criteria:

Location	Persons Per Square Mile	L_{dn} (dB)
Rural--Undeveloped	20	35
Rural--Partially Developed	60	40
Quiet Suburban	200	45
Normal Suburban	600	50
Urban	2,000	55
Noisy Urban	6,000	60
Very Noisy Urban	20,000	65

There are no existing sources of continous noise emissions in the immediate vicinity of the project. The nearest noise receptor is a ranch house about 10 miles to the southwest.

There are no Federal, state, or local noise standards which would directly regulate noise emissions from the proposed project during either construction or operation. There are, however, Federal noise guidelines, published by the EPA, which have a direct bearing on community noise levels that would be caused by construction and operation of the proposed storage caverns and pipeline. These guidelines are shown in table 11.

The noise exposure of construction workers is regulated by standards of the U.S. Department of Labor's Occupational Safety and Health Administration pursuant to the Occupational Safety and Health Act of 1970. These standards stipulate that workers shall be protected against the effects of excessive noise exposure and that such action may be accomplished by administrative or engineering controls. If such controls do not reduce harmful noise levels, protective equipment is required.

TABLE 11

NOISE LEVELS WHICH ADEQUATELY PROTECT PUBLIC HEALTH

EFFECT	LEVEL[a/]	AREA
Hearing Loss[b/]	$L_{eq(24)} \leq 70$ dB(A)	All areas
Outdoor activity interference and annoyance	$L_{dn} \leq 55$ dB(A)	Outdoors in residential areas and farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use.
	$L_{eq(24)} \leq 55$ dB(A)	Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.
Indoor activity interference and annoyance	$L_{dn} \leq 45$ dB(A)	Indoor residential areas
	$L_{eq(24)} \leq 45$ dB(A)	Other indoor areas with human activities such as schools, etc.

a/ The level required to prevent hearing loss represents exposure over a long period and should not be identified with short-term or single event noises.

b/ Represents annual averages of the daily level over 40 years. (These are energy averages, not to be confused with arithmetic averages.) EPA has determined that a level which protects 96 percent of the population will protect virtually the entire population. This level has been calculated to be an L_{eq} of 70 dB over a 24-hour day.

Source: EPA, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," March 1974, page 3.

J. CULTURAL RESOURCES

A cultural resource survey of 3,840 acres of the plant site and 41 miles along the proposed pipeline route performed by Pataya's consultant, WESTEC Services, Incorporated, identified 21 previously unrecorded prehistoric archaeological sites, 43 isolated finds, and a historical concrete slab foundation. Ceramics and other household debris were scattered around the foundation. Four previously recorded sites are near the proposed pipeline; one of these, BLM-AR-020-1001, would be within the right-of-way itself. It consisted of several groundstone implements and fragments, a quartzite hammerstone, and one dark brown pottery sherd.

The sites and isolates discovered during the survey in Hualapai Valley represent three basic activities: hunting, represented by the isolated projectile points; seed processing, represented by isolated manos and metates (grinding stone implements) and by sites where grinding stones and ceramics occur together; and tool maintenance, represented by sites consisting entirely of chipping waste and sites where hammerstones occur in association with grinding stones. Without exception, the sites in the project area are small, reflect activities limited to plant processing and tool maintenance, and are in areas where seasonally available resources occur. No evidence of subsurface deposits was noted at any of the sites during the survey.

The Keeper of the National Register of Historic Places, in cooperation with the Commission and the Arizona State Historic Preservation Officer, determined 22 sites (including the previously recorded site) to be eligible for the National Register of Historic Places. (See appendix E.) They are eligible because they might yield data on the size and nature of task groups exploiting the valley, temporal relationships among the ceramic sites and between the ceramic and lithic sites, and the resources that were exploited within the valley and when they were used.

CHAPTER FOUR
ENVIRONMENTAL IMPACT

A. AIR QUALITY

Air quality would be affected temporarily by construction of the proposed facilities and by exhaust emissions from the natural gas fueled compressor units, dehydrator unit, and electric power generators for the life of the project.

1. Construction

Projecting emissions from construction is difficult because of variations in activity levels, locations of emission sources, and poorly defined air pollutant emission factors. Any attempts to translate such emissions into ambient air quality impact are imprecise.

Pollutant emissions during construction of the proposed pipeline, evaporation pond, and storage caverns would depend upon the type and amount of equipment used and the extent of its use. Ground-level concentrations of pollutants would depend on the relative locations of construction activities. In general, emissions during construction would include fugitive dust (TSP), nitrogen oxides, carbon monoxide, sulfur oxides, and water vapor. Dispersion of these pollutants would depend on local atmospheric stability and meteorological conditions.

Because of the low soil moisture content, fugitive dust would be the most serious concern during construction on the arid soil of Hualapai Valley, causing temporary and minimal deterioration of the ambient air quality. Construction would cause localized, short-term dust conditions, since almost all surface-disturbing activities generate varying amounts of dust.

There is currently no EPA-approved model for calculating dust dispersion from construction vehicles. Construction of the evaporation pond would generate by far the most dust, releasing about 0.75 ton per day into the air. The daily maximum total from all construction would be less than 1 ton; however, not all of the dust would be generated simultaneously. Table 12 summarizes the potential fugitive dust emissions which would result from construction of the project.

TABLE 12

POTENTIAL FUGITIVE DUST EMISSIONS FROM CONSTRUCTION OF THE RED LAKE STORAGE PROJECT

Operation	Acres Disturbed Per Day	Fugitive Dust Emissions (Tons per Day) a/	Duration of Construction (Days)	Total Emissions (Tons)
Plant Site Construction	0.5	0.01	304	3.04
Roadway Construction	1.15	0.02	304	6.08
Gas Pipeline Construction	2.3	0.05	150	7.50
Evaporation Pond Construction	3,000 cubic yards b/	0.15 b/	50	9.0 b/
	20 c/	0.60 c/	60	36 c/

a/ Assuming dust control by watering. Not all emissions would occur on the same day.

b/ Related to construction. Moving 150,000 cubic yards in 50 days.

c/ Related to wind erosion.

There are no Federal permits which Pataya must obtain from the EPA before begining construction.[1/] However, the State of Arizona regulates fugitive dust emissions from new construction projects. The regulation states that no one shall let any open area, suburban or urban, be cleared, altered, leveled, or excavated without taking reasonable precautions to limit excessive airborne particulate matter. Dust and other air contaminants are to be kept to a minimum by practices such as using an approved dust suppressant or adhesive soil stabilizer, paving, concrete, landscaping, or continous wetting. The Arizona Department of Health Services, Division of Environmental Health Services, will make the necessary recommendations for fugitive dust control when Pataya applies for an installation permit, which must be obtained before construction.

All roadways to be constructed for the Pataya plant would be graded and surfaced with gravel. Dust abatement problems caused by construction would be mitigated by spraying the roadbeds with magnesium chloride solution in a 32-percent concentration. While high concentrations of magnesium chloride are toxic, there is no information available on the ecological effects of its use for dust abatement. This product has been endorsed for this use by the U.S. Forest Service. Several counties in Utah and Idaho use it, and the EPA regional offices in Denver and Dallas have suggested that applicants with severe dust problems investigate magnesium chloride applications.

2. Operation

The actual operational air impact of the proposed project would depend upon the number of days per year that the natural gas compressors, electrical generators, and auxilary equipment are operated. Initially, Pataya proposes to compress 54 million cfd into the storage caverns and to operate the three 1,800-horsepower reciprocating compressors for only 90 days each year.

Pataya has chosen to install its own onsite electrical generators instead of constructing the 69-kV electrical powerline previously proposed. The plant's electrical requirements would be supplied by four 325-kilowatt generators. During solution

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1/ This applies only to site preparation. A PSD applicability determination would be necessary before construction of the compressor station begins. In addition, a new source installation permit allowing Pataya to begin construction would be required from the Arizona Department of Health Services, Division of Environmental Health, Bureau of Air Quality. Furthermore, Pataya would be granted an operational air permit from the Bureau of Air Quality when Pataya proves that it would not exceed its emission limitation identified in its construction permits.

mining, three units would be operated with one unit on standby. Power for all four units would be an LPG/natural gas fueled 465-horsepower reciprocating engine. LPG would be used as generator fuel until the natural gas pipeline to the site is completed (about 10 months after solution mining begins).

In addition, the solution mining injection pumps originally designed to operate on electrical power would be driven by four LPG/natural gas fueled 715-horsepower turbocharged reciprocating engines. Four 12,000-gallon and one 5,000-gallon LPG storage tanks and a 500-gallon diesel fuel tank would be installed. Vapor recovery units would only be installed on the 500-gallon diesel fuel tank because the LPG tanks would be pressurized, vapor-tight storage vessels.

Air emissions from the compressor station and the LPG/natural gas fired electrical generators would be the major long-term air quality impact related directly to the operation of the proposed plant. The applicant has not specified how many of the proposed electrical generators would be required after solution mining ends. Generators would be required to supply plant electrical requirements and to maintain a suitable backup. Other long-term impacts would include the fugitive dust generated by salt transport trucks and by plant personnel driving daily on the plant's access road. Permanent exhaust emissions would also be generated by the natural gas dehydration unit.

Table 13 shows that nitrogen oxides (primarily NO_2) would be the only potential pollutant emitted in excess of 250 tons per year, the EPA criterion of a new major emitting source under the PSD regulations. Therefore, it is the only pollutant that is analyzed for potential ground-level impact.

As a new major source, the Red Lake Compressor Station would require approval under EPA's PSD review program before construction and operation of the new source begins. Pataya claims that no PSD review would be necessary because the proposed compressors would only operate for 90 days each year and produce emissions equaling only one-fourth of the equipment's potential to emit, calculated as Case I in table 13. However, PSD regulations state that any new source with the potential to emit more than 250 tons per year of any criteria pollutant must obtain a PSD applicability determination. Even though Pataya plans to reduce its emissions by limiting

TABLE 13

POTENTIAL EMISSIONS FROM THE RED LAKE STORAGE PROJECT

	Units	Number of Units	Installed Horsepower	Emissions (Tons/Year)				Annual Operation (Days/Year)	Fuel Requirements (Thousand Cubic Feet/Year)
				Nitrogen Oxides	Carbon Monoxide	Hydro-Carbons	SO_2		
Case I: Potential to Emit	Compressors[a]	3	5,400	568	73	23	0.09[b]	365	160,000
	Dehydrator	1	[c]	2	0.38	0.15	[d]	90	2,400
	Generator	1	[c]	14	2	0.60	[d]	90	8,500
Case II: 90 Days of Operation	Compressors[a]	3	5,400	142	18	6	[d]	90	40,000
	Dehydrator	1	[c]	2	0.38	0.15	[d]	90	2,400
	Generator[e]	1	[c]	14	2	0.60	[d]	90	8,500
Onsite Power	Electrical Generators[e]	4[f]	1,860	228	27	2.0	[d]	365	1,031,520 gallons/year[g] 32,361[h]
	Solution Injection Pumps[g]	4	2,860	338	43	14	[d]	365	1,623,538 gallons/year[g] 50,916[i]

a/ Reciprocating natural gas compressor units.

b/ All compressor operations at maximum horsepower for 365 days per year.

c/ No horsepower figures are available for those compressors.

d/ These values are insignificant.

e/ Emissions calculated from fuel consumption data and EPA's AP 42 emission factors.

f/ The applicant has not specified the number of generators required after construction.

g/ Assumes operating on LPG for 6,515 hours per year.

h/ These units would operate for 15 months only.

i/ Assumes operating on natural gas for 2,245 hours per year.

the number of days the compressors operate and possibly to install lean-burn reciprocating compressor units to further reduce nitrogen oxide emissions, EPA regulations state that Pataya must obtain a federally enforceable PSD permit.1/

All of the compressors, electrical generators, and pump drives would have to comply with the NAAQS for nitrogen oxides--an annual arithmetic mean of 100 µg per cubic meter. All natural gas fueled internal combustion engines identified in this EIS would not have to comply with the new source performance standards which EPA proposed for stationary, natural gas fired, internal combustion engines. EPA has abandoned the standard for natural gas fired internal combustion engines because the proposed control mechanisms resulted in significant increases in carbon monoxide emissions.

The staff conducted a worst-case screening analysis of the potential ground-level concentration of nitrogen oxides that would be emitted by the proposed natural gas compressors, electrical generators, and mechanical pump drives of the solution-mining injection pumps. Using the PTMAX model, the staff calculated a worst-case ground-level concentration of nitrogen oxides by assuming that three 1,800-horsepower reciprocating natural gas compressors, four 465-horsepower electrical generators, and four 715-horsepower natural gas fueled pump drive units would be operated simultaneously. This calculation resulted in a ground-level nitrogen oxide concentration of 161 µg per cubic meter at an average distance of 105 meters from the source. Assuming a background concentration of 20 µg of nitrogen dioxide per cubic meter, the ground-level concentration resulting would be equivalent to 181 µg per cubic meter.

When a violation of the NAAQS of 100 µg per cubic meter for nitrogen dioxide is recorded when modeling a source with the PTMAX model, the EPA recommends a more refined air model be used to quantify the potential ground-level concentration of nitrogen oxides. The staff selected the Industrial Source Complex Model to refine its air analysis. The initial computer run identified a maximum ground-level nitrogen oxide concentration of 289 µg per

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1/ Richard Bondi, EPA Division of Compliance, Washington, D.C., telephone conversation with Commission staff, May 27, 1981. The EPA requirement to obtain a federally enforceable PSD permit was stayed as of July 15, 1981. Public comments on a revised regulation (which considers the actual period of time the equipment would operate rather than its potential to emit) were filed with the EPA until August 14, 1981. The final outcome of the proposed revision has not yet been made. As of October 31, 1981, the partial stay on Federal regulations expired. Therefore, these regulations were considered in calculating the air emissions to be generated by the proposed compressors, electrical generators, or pump drives.

cubic meter about 300 meters from the source.[1/] The elevated level of nitrogen oxides is a result of the low stack heights proposed for the electrical generators and mechanical pump drives. For computation purposes, the staff raised the stack heights to 15 meters, as recommended in EPA's guidelines for stack heights for industrial sources. In addition, it assumed that three of the electrical generators and pump drives would be used instead of the four proposed units. The resulting peak ground-level concentration of nitrogen oxides would be equivalent to 76 µg per cubic meter 510 meters from the source. When the background concentration of 20 µg per cubic meter is added, the total ground-level nitrogen oxide concentration would be 96 µg per cubic meter, which is below the 100 µg per cubic meter NAAQS for nitrogen oxides.

The EPA's Region IX would determine whether the facility would be considered a new major source. The environmental staff believes that, with the appropriate PSD review or determination, no significant air quality impact would occur.

No impact upon any Class I area is expected from construction and operation of the proposed project. Visibility would not be degraded in the Grand Canyon National Park because the potential emission rate of nitrogen oxides would not exceed the threshold of impairment established by the EPA.

B. TOPOGRAPHY AND GEOLOGY

1. Topography

Construction of the proposed project would alter the natural topography in several ways.

The proposed cavern site would be cleared and graded to facilitate construction and installation of other equipment and to provide drainage for precipitation.

Construction of two well pads, each approximately 1 acre, would result in minor positive topographic relief which would remain in place for the life of the project. Temporary mud pits, adjacent to each well site, would be surrounded by low berms and would be filled in following drilling.

1/ This level does not take into account the ozone-limiting method, which allows for only that portion of the nitrogen monoxide that is numerically equivalent to the annual average ozone concentration to be oxidized. The actual stack emissions of nitrogen oxides may be 90-percent nitrogen monoxide and 10-percent NO_2, as demonstrated in test cases.

A water storage reservoir or raw water feed pond on the cavern site would be 80 feet by 160 feet, 10 feet deep and stand approximately 12 feet above the surrounding terrain, lined with reinforced plastic.[1/] It would be part of the permanent plant facilities.

The site access roadway would also require some slight positive topographic relief, with culverts installed to provide drainage underneath the road. The alternative access road currently being evaluated by BLM would require 3 feet of gravel fill within the floodplain of Truxton Wash and would therefore cause more of a topographic impact than the roadway proposed in the FERC application.

The clearing and grading of the pipeline right-of-way would have a slight topographic effect, but since there is little relief along the proposed route, no extensive topographic alterations are anticipated. Following burial of the pipeline, a low crown or mound of loose soil over the ditch would allow for the slow settling of the pipeline and disrupted soil. Extra soil from the pipeline ditch would be spread evenly over the right-of-way or disposed of elsewhere.

Ground surface subsidence is a permanent topographic impact which could follow failure of the proposed caverns, large-scale groundwater pumping, or soil compaction. Only minor subsidence would be expected at the pond site. Subsidence in the water well area could effectively increase the size of the playa and cause the area to become inundated during floods. Subsidence associated with the caverns is likely to be almost imperceptable.

Temporary topographic impact would be associated with the proposed evaporation pond. Approximately 36,000 linear feet (7 miles) of 4.5-foot high soil dikes are proposed to be constructed on the smooth and level surface of Red Lake. Upon abandonment of the pond, the site would be leveled and restored to its original appearance.

Rip-rap, sand, and gravel for plant construction would be obtained from borrow pits in Sections 19 and 29, T.26N., R.17W. Approximately 150,000 cubic yards would be required to construct the evaporation pond and all-weather access roads and to replace unsuitable soil at the cavern site. This could create one or more 6-foot deep pits totaling 15 to 20 acres, which would probably be visible from Stockton Hill Road. The topographic impact could be minimized by filling the pits with soil excavated from the cavern site and the pipeline trench.

1/ The Arizona Division of Dam Safety would have to issue a permit for construction of the raw water storage pond.

2. Geology

a) Cavern/Compressor Site

The proposed facility would have to comply with the State of Arizona Oil and Gas Conservation Commission's Rule No. 706--"Storage Cavity Design and Construction." Standards regarding construction and operation of a storage cavity for liquid or gaseous substances are contained in the rule.

A major factor in the design of the storage caverns is structural stability. A geomechanical analysis of the cavern spacing and layout has been conducted using data from the El Paso cores.[1/] Two important elements affecting structural stability are the minimum salt back thickness--the thickness of load-bearing material above the cavern roof--and the minimum pillar thickness between caverns. The analysis is conservative, since the salt is assumed to have a relatively low compressive strength (2,600 psi) and the sediments overlying the salt body are assumed to be incapable of providing sufficient support. Results of the preliminary analysis indicate that a minimum salt back thickness of 312 feet and a minimum pillar thickness of 340 feet would be required. The proposed salt back thickness of 2,000 feet would exceed the minimum specified. The planned cavern distance (center to center) of 650 feet would provide a margin of 180 feet (to allow for well deviation and localized diameter increases due to differential leaching) over the minimum specified pillar thickness of 340 feet. Gas pressure in the caverns would assist in balancing the overburden and lateral stresses.

The maximum bottom hole pressure would occur during the latter stage of solution mining. A maximum top hole pressure of approximately 1,100 psi would be needed to lift the brine to the surface. Adding to this the weight of a 5,100-foot column of brine (0.53 psi/foot) yields a maximum bottom hole pressure of approximately 3,800 psi or 80 percent of the theoretical overburden pressure (0.9 psi/foot), the probable minimum necessary to initiate hydraulic fracturing of the salt. The maximum bottom hole pressure during gas storage operations would not exceed 3,200 psi.

The geomechanical analysis was based on the physical properties of material recovered from a nearby well. Since the mechanical properties of salt deposits can vary considerably over short distances, the final design of the Pataya facility must be based on analyses of salt cores taken from Pataya wells. Until such samples are analyzed to verify the assumptions used in the preliminary design, it is impossible to determine whether the portion

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1/ PB-KBB, Inc., Geomechanical Assessment of Caverns: Pataya Natural Gas Storage Facility (Houston, June 1980).

of the salt body underlying the proposed site is suitable for the proposed caverns. (A more sophisticated, finite element modeling technique, which is available for cavern design analysis, has been recommended by the applicant's solution mining consultant to supplement the empirical method used in the preliminary geomechanical analysis.)

High-quality solution well drilling and completion (i.e., casing and cementing) is of critical importance to successful cavern construction and operation. Existing information is inadequate to conclude that the proposed cavern space is free of any faults, fractures, natural solution cavities, or a large volume of insoluble rock, which could affect cavern development. Each of these complications could have serious cost and environmental impact on the project, but none could be verified until the wells were drilled.

Faults and fractures which intersect the caverns might serve as channels for groundwater flow. Uncontrollable flooding or drainage of the developing caverns (depending on relative fluid potentials) could occur, making construction of an airtight cavern impossible. Natural solution cavities could have a similar effect. Pressure testing and detailed logging of the solution wells before mining would minimize the possibility of such problems. A cavern that is not tight would be an unacceptable storage vessel and would probably have to be abandoned soon after the failure was discovered.

If faults were encountered in the solution wells, seismic activity could be induced. The increased fluid pressure created during the solution mining would tend to decrease the shear strength on the fault plane, which could cause an earthquake if slippage occurred.

If a large volume of insoluble rock existed in the cavern space, changes in the preliminary design of the caverns could be required. The current assumption is that 5 percent of the salt is insoluble and would be accommodated in a sump at the bottom of each cavern, between 5,000 feet and 5,300 feet below ground. (See figure 5 for a diagram of the leaching methods.) Roof falls or disloging of ledges from insoluble beds within the caverns could present construction problems such as breaking a leaching pipe string.

Operation of the proposed facility would require large pressure changes (1,000 to 3,000 psi) in the caverns and storage wells which would be of no particular concern with proper engineering and construction. Accidental overpressuring of the caverns could cause rock fracturing or well casing failure, with possible gas loss, minor seismic activity, or partial cavern collapse.

Earthquakes on distant faults would probably not cause any damage at the plant site. However, a sizeable event on the Grand Wash fault system could result in extensive damage, particularly

to the surface facilities, if intense shaking, faulting, or other ground failures occurred. Data currently available suggest that such an event would be a remote possibility. In the absence of any specific regulations concerning earthquake design or proximity to active faulting, the applicable structures would be designed in accordance with the earthquake loads specified in the Uniform Building Code for Seismic Zone 2.

Since salt tends to flow under stresses typically encountered at depth (a process termed "creep"), the caverns would tend toward closure once they were fully developed. Assuming that salt behavior in the proposed cavern area would not be significantly different from the salt cores recovered from the El Paso well, the cavern closure rate over 20 years would probably not exceed 10 percent.

Reduction of the usable volume is not the only consequence of creep deformation. Construction of underground cavities causes movements and induces stress changes in the surrounding rock mass. Salt creep deformation can cause structural failure, resulting in caving and rupture. If these failures propagate to the surface, subsidence would occur. The proposed caverns are designed to preclude significant surface subsidence. The caverns would be developed deep within the salt body (4,000 to 5,300 feet below ground), and the closure rate would have a very minor impact at the surface.

Should additional caverns be constructed, baseline information on the rate and magnitude of subsidence movements would be important, particularly in light of the large groundwater withdrawals proposed. Therefore, subsidence survey bench marks should be established so that the precise elevation of areas where subsidence could occur could be measured each year. In this manner, slow but otherwise undetected movements that could damage the facility would be recorded over a period of time. (See recommendations, chapter 5.)

b) Evaporation Pond Site

Assuming proper design, construction, maintenance and abandonment of the evaporation pond, minimal impact should occur. The staff's investigation of the giant mud cracks in the vicinity of the pond site indicate that they are filled with fine-grained material and should therefore be effectively sealed against excessive seepage. However, the development of new cracks or the presence of unhealed cracks at depth could present several problems. As discussed in section 3.D.2, the formation of these cracks is an ongoing process, but the time and location of future cracking cannot be predicted with the currently available information. Should new fissures occur within the evaporation pond, brine could be lost and groundwater contaminated. If the fissure breaches a perimeter dike, brine could be spilled onto adjacent areas of the playa and the pond rendered unusable.

There is evidence which suggests that certain fine-grained sediments are susceptible to shrinking when concentrated brine is ponded on them. This occurs because the brine tends to draw fresher water from the underlying sediments, resulting in a desiccation effect. Vertical fissures (not giant mud cracks) which could disrupt the continuity of the mechanically compacted pond floor may form. If this phenomenon occurs at the proposed brine pond, it might be possible to recompact the pond floor as a remedial measure. The cut-off wall which would be constructed below the perimeter diking would prevent shallow lateral seepage of brine.

C. SOILS

1. Storage Site, Access Roads, Gravel Pits

Constructing the proposed storage facility and access roads would require a substantial amount of earthwork. Irregular terrain would be graded, foundations for aboveground facilities would be excavated and replaced with engineered fill, and gravel would be spread over the plant site for roads, parking lots, and other areas. The all-weather site access road, whether constructed from Stockton Hill Road or Antares Road, would require excavating a roadbed for engineered fill. The precise amount of soil that would be excavated and replaced with fill would depend on further engineering analysis and requirements arising during construction. The volume of soil excavated from the plant site and access road would exceed 40,000 cubic yards, and over 110,000 cubic yards of engineered fill might be installed. Because of the inherently low productivity of the soil, this would not create a significant effect. However, the large quantity of earthwork, coupled with the nearly constant wind, would cause substantial dust during construction. (See section 4.A.) To reduce soil blowing during construction of the plant site and access roads, mulch and/or chemical soil stabilizer could be used. This could reduce the amount of blowing dust. However, as a practical matter, the problem could not be eliminated. The staff has recommended that the excess soil excavated during construction be disposed of and stabilized in the proposed gravel pits during or immediately after construction.

2. Evaporation Pond

Pataya proposes to construct the evaporation pond dikes by scraping 1.25 inches of soil from inside the pond site and moving the soil to the dike locations. The pond floor and the dikes would be compacted, and the interior dike walls would be lined

with approximately 21,000 cubic yards of rip rap from the proposed gravel pits. The total length of the diking, including 2.3 miles of interior dike, would be approximately 7 miles. A site plan of the pond is shown in figure 7.

A number of soil tests have been conducted to ascertain the suitability of the playa for the proposed pond. These tests, described in section 3.D, generally indicate that the soil conditions are suitable for the proposed pond. Based on these tests, the staff concludes the following.

> With conservative slope design, the dikes could be constructed from the native playa soil without risk of slope failure or excess internal seepage. Subdike seepage would be prevented by excavating and compacting native soil in a 3-foot deep, 2-foot wide trench (cut-off wall) beneath the dikes.

> The pond floor could be compacted to the proposed density and depth. This would prevent seepage of the brine beyond the depth of the compacted layer.

> Foundation settlement should not be a problem, although more representative consolidation testing would be desirable to predict settlement over the entire pond site and to implement appropriate design constraints.1/

Although tests indicate that the playa soils can be used, the tests and field observations reveal certain limitations which must be considered. Graphs of the soil's moisture-density relationship indicate there is a very narrow range of moisture at which proper compaction can be obtained. A difference of as little as 4 percent moisture by weight from the optimum would significantly reduce the obtainable soil density. Considering the high evaporation rate in the project area, applying and maintaining the proper moisture would be difficult. Another limitation, revealed during the staff's February 1982 field investigation, is the relatively loose consistancy of the upper 2 to 3 feet of the playa soil. Compacting a 9-inch layer of the pond floor to 90-percent relative compaction, as proposed, may require excavating and compacting the pond floor in several lifts, since soil cannot be properly compacted against an excessively

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1/ The staff attempted to obtain representative samples to test undisturbed consolidation during its February 1982 field investigation. Only one sample could be obtained because of inclement weather.

loose, resilient subsoil. If proper compaction was not obtained, the proposed dikes and pond floor might not retain the brine solution. Although these problems would not be insurmountable, Pataya's current construction plan does not consider them.

Another limitation revealed by the tests and field observations is the soil's shrink-swell capacity and propensity for forming shrinkage cracks. Under light loads, such as would be expected at the surface of the dikes and pond floor, the compacted soil absorbs moisture and swells. In drying, the soil shrinks, but does not shrink to its original density. Thus, compaction would be lost in the layer affected by shrink-swell. Complete drying of the soil leads to shrinkage cracks. The cyclical wetting and drying associated with the salt harvesting operations would, over a number of years, reduce compaction of the pond floor. This loss would be hastened if the pond floor was allowed to dry and crack between filling cycles. The dikes would undergo similar loss of compaction and shrinkage cracking. The staff expects that the pond, if constructed properly, would be serviceable for the proposed project. However, the desiccated and/or uncompacted layer could require recompaction before the pond could be used for additional brine reduction.1/ SCS engineers have observed similar effects after only 10 years of operation of larger dikes constructed in Arizona.2/

Because of the unique problems that could occur in constructing the pond to the proposed specifications, the staff has recommended that Pataya retain a qualified soils engineer or engineering geologist to perform any necessary additional tests, to finalize the design and construction plan of the pond floor and dikes, and to monitor their construction. Because of a multitude of variables, the staff cannot accurately assess the probable useful life of the pond beyond the proposed project. However, any future expansion of the plant would require Commission approval and thus be subject to further environmental review.

D. WATER RESOURCES

1. Surface Water

Little or no significant impact would occur to streams in the area because of the proposed project.

1/ Pataya could ensure longer service life of the pond by constructing larger dikes and a thicker pond floor.

2/ Douglas Pease, SCS, Phoenix, Arizona, telephone conversation with Commission staff, February 12, 1981.

However, while the potential for streamflow sufficient to flood the proposed facilities in Red Lake appears to be remote, historic streamflow data are too limited to accurately determine a probable worst case such as a 100-year flood. Within the last 50 years, water depths over the floodplain created by Truxton Wash have reached a maximum of 2 feet. A period of prolonged rain such as that which contributed to the floods of 1904 could impact the proposed facilities. Accidental brine spills which could result from a dike failure would contaminate the playa surface and drastically increase the salinity of floodwater if the spill were not cleaned up.

Constructing the access road from the plant site to Stockton Hill Road to accommodate all-weather traffic would require installation of approximately 35,000 cubic yards of engineered fill in the broad floodplain of Truxton Wash. Several culverts would be needed to allow floodwater to flow onto the playa. Large flows could be temporarily impounded upstream of the road, causing flooding and possibly excessive maintenance. The staff believes that since this roadway would be needed only during construction, the disruption that would be caused by constructing a permanent all-weather access road is not warranted. The access road should be constructed at grade and avoided during wet weather, if necessary, as originally proposed. Propane delivery trucks (for which the engineered fill requirements were specified) could approach the plant site via the proposed all-weather access road from Antares Road.

2. Groundwater

a) Groundwater Production

Although insufficient hydrogeologic information is available to accurately assess the effect of the proposed project on existing groundwater resources in Hualapai Valley, several general statements and rough estimates can be made. The staff recommends a comprehensive groundwater monitoring program to accurately assess the effects of the proposed project and to develop baseline data which would allow more realistic evaluations and expeditious review of any future facility expansions. There are currently no groundwater users between the proposed well field and the Lake Mead National Recreation area, approximately 20 miles to the north.

What constitutes the safe yield of a groundwater basin has been variously defined. Some have suggested that the safe yield is an amount equal to the annual groundwater recharge. A more generally acceptable definition may be the amount of water that can be withdrawn annually without producing an undesired result. Potential undesired results could include not only the depletion of the groundwater reserves but the intrusion of water of undesirable quality and the increased cost of pumping.

A more rigorous concept is that of optimal yield. The optimal yield is determined relative to a comprehensive groundwater management scheme--one which best meets a set of economic and social objectives associated with the uses of the water. Since the environmental staff is not aware that such a management plan for Hualapai Valley currently exists and because the development of this type of plan is clearly beyond the scope of this FEIS, it cannot determine whether a reduction in groundwater reserves because of the proposed project would have an adverse socioeconomic effect. The safe yield, however, could be exceeded.

Gillespie and Bentley estimate a subsurface outflow from the Hualapai Valley groundwater basin of 5,000 acre-feet per year. Of this amount, 4,000 acre-feet is estimated to leave the valley north of Red Lake annually and 1,000 acre-feet per year is estimated to leave southeast of Hackberry. Gillespie and Bentley also estimate that total storage in the aquifer is between 10.5 and 21 million acre-feet. On the basis of these estimates, the projected requirement of 4,000 acre-feet for construction of the proposed caverns would roughly equal the annual outflow to the north of the basin; it is less than 0.05 percent of the total amount of water stored in the aquifer.

However, while Gillespie and Bentley estimate the groundwater reservoir in Hualapai Valley to be 460 square miles, approximately the eastern one-half of the valley was not represented by any well data at the time of their survey. Since then several test wells were drilled in the vicinity of the proposed cavern site, and thick clayey deposits were encountered. (See figure 25.)

Taking into account the relative volume of impermeable materials observed in these test wells, Remick recalculated the annual outflow to be 2,000 to 2,500 acre-feet, or approximately half of Gillespie and Bentley's earlier estimate. He also reports that 4,000 acre-feet per year has been pumped from the basin between 1967 and 1977, and 6,000 acre-feet per year since 1978. Therefore, the total annual withdrawl, including that of the proposed project, would be approximately 10,000 acre-feet or 4 to 5 times the latest outflow estimate. Additionally, while the proposed pumping for the project would be temporary (14 months), Pataya has suggested that the construction of additional caverns is probable, implying continued groundwater withdrawals.

It is uncertain how much of the recharge available to the basin would be available to the proposed project area. A recent U.S. Geological Survey Report suggests that the Older Alluvium may constitute a multiple aquifer system.[1/] This could influence the accuracy of the project's estimated effects on the groundwater system. For example, well-pumping drawdown estimates assume that aquifer depletion would not occur. If, however, an aquifer is totally confined or recharge is slow, drawdown significantly larger than estimated could occur. Partial penetration of the aquifer also results in inaccuracies of the predicted effects.

Pumping tests of water wells proposed to provide water for the solution mining operation were conducted in April and July 1981 (CER 3 and CER 4) and July 1973 (Neal No. 1). All of these wells are located in SW 1/4, section 23, T.26N., R.17W.

The test of CER 4 with observation measurements from both CER 3 (approximately 3,200 ft to the southeast) and Neal No. 1 (approximately 2,100 feet to the south) yielded a transmissivity of 237,600 gallons per day per foot and a storativity of 8.3×10^{-4}, indicating confined or semiconfined aquifer conditions. These tests further demonstrated that there is a sharp decrease in well transmissivity to the east of Truxton Wash; the barrier is postulated to be approximately 1 mile to the east of CER No. 4. Using these values and a pumping rate of 3,000 gallons per minute averaged over the well field area, calculated drawdowns for an ideal confined aquifer bounded by an impermeable barrier 1 mile distant are:

Distance from Center of Pumping Parallel to Impermeable Boundary 1 Mile Distant	Drawdown[2/] (Feet)		
	14 Months	3.5 Years	5 Years
1 mile	24.25	27.48	28.56
2 miles	21.61	24.80	25.76
5 miles	17.17	20.27	21.31
10 miles	13.24	16.42	17.51

Given these observations, the potential for aquifer overdraft is indisputable, and the accompanying undesired results such as storage reduction, chemical quality changes, flow redirection, and land surface deformation could occur because of the proposed project. Changes like chemical quality alterations and ground surface subsidence are long-term and essentially irreversible. Since there are currently no other groundwater users in the vicinity of the proposed plant, no one would be directly affected.

1/ Sigrid Asher-Bolinder, James D. Vine, and James D. Morgan, Lithology and Lithium Content of Sediments Drilled in a Test Hole on Red Lake, Hualapai Valley, Mohave County, Arizona, (Washington, D.C., 1979), p. 12.

2/ Method of Images (Drawdown below the pond site would be slightly higher.)

The groundwater regime in one area of the Hualapai Valley--the Hackberry Well Field--has already been altered because of drawdown. Under natural conditions, some groundwater moved from the Hackberry area northward over a shallow bedrock barrier into the main part of Hualapai Valley. Pumping during the 1960's lowered water levels so that little or no groundwater now flows into the main part of Hualapai Valley from Hackberry, and these wells have since been abandoned as a municipal water supply. A similar disruption could eventually occur at the outflow area to the north of Red Lake.

One depositional feature common to all groundwater-induced land subsidence sites is a thick sequence of unconsolidated or poorly consolidated sediments forming an interbedded aquifer-aquitard system. Water is pumped from sand and gravel aquifers, but a large percentage of the area consists of highly compressible clays (aquitard). At the project site, pumping is from sand and gravel strata below clays which extend from a depth of 400 or 500 feet to above the static water level depth of approximately 260 feet. If a significant drop in hydraulic head occurred in the aquitard because of leakage into the pumped aquifer, the resulting increase in effect stress acting through the vertical compressibility of the aquitard would cause compaction of the aquitard, which in turn could result in subsidence. The environmental staff recommends a subsidence monitoring program. (See recommendations, chapter 5.)

Water level drawdown could induce further large-scale cracking on the playa and other nearby areas which are underlain with the material that is undergoing the desiccation. A group of fissures which appeared in the vicinity of the water wells after the most recent aquifer testing might indicate a causal relationship. Field instrumentation and groundwater monitoring programs are recommended to (1) determine whether there is indeed a cause-and-effect relation between large groundwater withdrawals and the active fissuring and (2) to begin to develop the necessary baseline data upon which mitigation measures could be devised, if necessary.

Whether Lake Mead would ever be affected by the proposed project depends on whether hydraulic communication exists between the groundwater system discharging to Lake Mead and that which would be pumped for the proposed project. If communication exists and if flow is into Lake Mead, the reduction in storage in the aquifer would slightly decrease the discharge to Lake Mead.

If the existing discharge to Lake Mead is of lower salinity than Lake Mead, a reduction in the amount of water discharged from the Hualapai groundwater basin would effectively increase the salinity of the lake, but only slightly. If pumping from the aquifer in the project area caused a redirection or mobilization of water of poorer chemical quality, that water would be produced out of the pumping wells or entrained into the local groundwater flow system and eventually discharged into Lake Mead. It would be thousands of years before the contaminants reached Lake Mead.

There could, however, be a contaminant plume extending from the vicinity of the pumping center to the source of the poor quality water with some component of flow toward Lake Mead. This is, of course, a highly simplified scenario, and a considerable amount of detailed information would be necessary to determine the potential for this and to plan an appropriate method of avoidance. While either reducing the outflow or creating an outflow of altered quality or both would constitute a long-term impact to Lake Mead, neither impact should be of particular significance because of the relative volumes of the lake and the valley outflow.

b) Evaporation Pond Site

It is possible that the brine could seep through the playa sediments at the evaporation pond site and contaminate groundwater reserves. Of primary concern is the chloride ion, which is relatively mobile in groundwater systems. Sodium is also important to groundwater quality, but it is more likely to be attenuated by the clayey deposits under slow seepage conditions. The question that arises is whether seepage of brine or salt leachate would significantly increase the concentration of chloride in the fresh groundwater. Because groundwater moves so slowly, a rapid release of brine into the aquifer would significantly elevate chloride and sodium concentrations, but a slow, gradual release or rapid dilution could produce levels that would be well within acceptable limits. Although the major characteristics of groundwater flow and groundwater quality in Hualapai Valley are known, it is not known whether or how much water entering Red Lake percolates into the Older Alluvium aquifer or whether the playa is a distinct hydrogeologic system with little, if any, relation to other aquifers in the valley. Fine-grained playas, like Red Lake, are typically characterized by slow artesian and capillary movement of water through the surface and may, in fact, be areas of net groundwater discharge. Mechanical compaction of the pond floor, as proposed, would aid in minimizing the seepage potential. More extensive hydrogeologic study of Red Lake would be required to fully understand its hydrogeologic character. It is therefore prudent to assume that the playa is in hydraulic communication with the larger valley aquifer and that its contamination with salt should be avoided. Since the applicant now proposes to remove all of the salt upon abandonment of the pond site, the effects of long-term salt seepage are no longer a concern.

Field investigation of the giant cracks observed in the vicinity of the pond site indicates that they are "healed" with fine-grained material and should therefore not cause excessive seepage. If new cracks formed under the pond during operation or if the healing is superficial, a large volume of concentrated brine could be released into the aquifer. The water could then become unsuitable for drinking if the total dissolved solids rose above 500 mg/l. Higher levels of contamination could also render the water unusable for irrigation (total dissolved solids higher

than 700 mg/l) or livestock watering (higher than 7,000 mg/l). There are currently no groundwater users between the project area and Lake Mead, though the U.S. Geological Survey has identified the part of the Hualapai Valley groundwater basin within the Lake Mead National Recreation Area as a favorable source for future groundwater development.

Quantifying this type of impact on Hualapai Valley groundwater resources requires numerous assumptions; nevertheless, rough estimates can be formulated. Very generally, the dispersion rate of a nonreactive contaminant (e.g., salt) in a homogeneous porous medium (e.g., an aquifer of uniform physical characteristics) is governed by the average linear groundwater velocity and a characteristic of the porous medium known as the dynamic dispersivity. The dispersion rate of the contaminant along a longitudinal axis and lateral axes is the product of the average groundwater velocity and the longitudinal media dispersivity and lateral media dispersivity, respectively.

While this is a simple relationship, values for longitudinal and lateral media dispersivity can only be estimated. In the laboratory, values of longitudinal dispersivity have typically been in the range of 0.1 to 10 millimeters, with lateral dispersivity values normally lower by a factor of 5 to 20. However, many investigators have concluded that values of longitudinal and lateral dispersivities in field systems are significantly larger. Consequently, values of longitudinal dispersivity as large as 100 meters and lateral dispersivity values as large as 50 meters have been used in mathematical simulation studies of the migration of large contaminant plumes in sand aquifers.

For purposes of illustration, if a fresh fissure formed in the evaporation pond, up to 5.25×10^6 cubic feet of brine could drain directly into the aquifer.[1/] Highly saline water would contaminate fresh groundwater in a localized area, then slowly disperse. Dispersion rates were calculated with longitudinal dispersivity values of 1 meter (3.28 feet) and 50 meters (164 feet) and lateral dispersivity values 12 times lower (0.27 foot and 13.7 feet, respectively). Average linear groundwater velocity was estimated to be 0.056 foot/day using a hydraulic conductivity and porosity typical for silty sand (1.0×10^{-4} feet/second and 40 percent, respectively) and an average hydraulic gradient of 1:400 feet (0.0025). When the longitudinal dispersivity is 3.28 feet, the longitudinal dispersion rate is 0.184 square foot/day and the lateral dispersion rate is 0.015 square foot/day. When the longitudinal dispersivity is 164 feet, the longitudinal dispersion rate is 9.18 square foot/day, and the lateral dispersion rate is 0.76 square foot/day.

1/ 5.25×10^6 cubic feet represents the maximum volume of brine in two 225-acre pond sections at any one time--one section at 100-percent capacity (3 feet deep) and another 75 percent full.

Assuming that a freshwater aquifer beneath the proposed pond site is in hydraulic connection with Lake Mead, the time required for a contaminant slug to travel approximately 15 miles at a rate consistent with the average linear groundwater velocity would be 3,875 years. At that time, with a longitudinal dispersivity of 3.28 feet, the slug of contaminanted water 15 miles from the "spill" site would be 2,472 feet wide and 8,652 feet long with a maximum salt concentration of 388 mg/l. The spill with a longitudinal dispersivity of 50 meters (164 feet) would be 17,594 feet wide, 61,148 feet long and have a maximum salt concentration of 1.1 mg/l. Clearly, the estimates vary considerably depending upon the assumed values of the aquifer parameters. It would, nevertheless, take a very long time for the contaminants to mitigate an appreciable distance from the "spill" site under any credible assumptions. The slow movement of contaminants in groundwater and other uncertainties notwithstanding, a major effort should be directed toward prevention, since groundwater contamination is essentially an irreversible impact.

It is also possible that the brine would be trapped in a permeable zone or diffused into the unsaturated zone above the aquifer. In any event, natural and induced conditions in conjunction with the staff's recommended monitoring programs should help to prevent extensive undetected groundwater contamination. Briefly, these considerations are: (1) the depth to groundwater is at least 250 feet below the pond site, and the high transmissivity portion of the aquifer is more than 555 feet deep, if present at all beneath the pond site; (2) the observed rapid healing of cracks on the playa may limit brine drainage; and (3) the cone of depression caused by pumping might induce a steeper hydraulic gradient between the water well field and the pond site. Groundwater flow would then be reversed and, under ideal conditions, any brine that entered the aquifer below the pond site would flow toward the water wells, where periodic monitoring would allow early detection. Observation wells situated to the north of the pond site would provide a check on nonideal hydrogeologic conditions and aquifer response.

E. BIOLOGICAL RESOURCES

1. Vegetation and Wildlife

Approximately 1,200 acres would be disturbed during construction of the storage site, evaporation pond, access roads, and natural gas pipeline; however, in general, the affected areas are not particularly valuable wildlife habitat. About 900 acres of the disturbed area would be on Red Lake, which is essentially unvegetated and is little used by wildlife. Shadscale, saltbush, and desert grassland, all of which occur throughout the valley, comprise most of the remaining 300 acres.

Less than 150 acres of vegetated land would be used for permanent facilities, such as the storage site and access roads, which preclude revegetation. However, revegetation of the pipeline right-of-way and other temporarily disturbed land would be slow in this arid area. Erosion of the bare soil would also delay revegetation.

Vegetation clearing, grading, and other construction activities would kill some small mammals, reptiles, and possibly nesting birds. In general, this one-time loss would be insignificant because the affected species are common and only a small portion of the population would be impacted. Normal reproduction and emigration would ensure repopulation of available habitat.

Construction of the proposed facilities would not adversely affect raptor use of the valley. Except for the burrowing owl, raptor nesting in the immediate area is limited. The small reduction in prey-supporting habitat should not have a marked effect on raptor use of the area. The applicant has agreed to conduct a preconstruction survey to further identify raptor nesting sites, especially of the burrowing owl. Impact to the birds or nesting sites could be minimized by scheduling alterations or minor route changes.

The 900 acres covered by the evaporation ponds would be a minor attraction to waterfowl. Experience at other salt evaporation ponds suggests that a small amount of mortality would be expected among the birds using the ponds at Red Lake.1/ However, the number of birds affected should be small, because few birds migrate through the valley and those birds would be unlikely to linger on brine ponds lacking aquatic vegetation and animal life. Furthermore, if waterfowl mortality were noted, attempts could be made to repel the birds with noise-makers or other measures.

During evaporation and harvesting, some salt could be blown onto nearby areas. However, vegetation should not be significantly impacted since the amount of wind-blown salt would be limited by the applicant's current proposal to harvest the salt under wet conditions and to transport it directly from the ponds to the railroads at Hackberry. Little salt could be picked up by winds during the loading and transportation of wet salt.

Though the applicant proposes the direct transport of raw salt, it also suggests that circumstance may dictate constructing a 6-acre salt storage site adjacent to the evaporation pond. Even if this storage site is required, it is unlikely that vegetation is nearby areas would be affected by wind-blown salt. First, the stockpile would tend to "cake-up," which essentially prevents the

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1/ Al Regenthal, Utah Fish and Game Commission, telephone conversation with Commission staff, June 5, 1981.

wind from eroding it. Second, the areas near the site are either barren or vegetated by species which have some degree of salt tolerance. Finally, the environmental staff recommends that Pataya ensure that the salt is contained onsite.

Off-road vehicle use of the project area could increase as a result of the access roads and the pipeline right-of-way. However, any increase would probably be small and have little additional impact on vegetation and wildlife. Even without the proposed project, recreational vehicles have easy access to the area because of the existing roads and the easily negotiated terrain.

2. Endangered and Threatened Species

The FWS has indicated that no federally listed or proposed endangered or threatened species would be affected by the proposed project.

Two state-listed species would be minimally affected by the project. Although available hunting habitat of the zone-tailed hawk, as well as other raptors, would be reduced by several hundred acres, there would be no significant impact. Hunting habitat, while somewhat poor in quality, is not limited in the valley. No nesting sites are near the construction areas, so increased noise and human activity would not disturb nesting.

Desert tortoises are not likely to be impacted, since neither the storage site nor the pipeline right-of-way would affect high quality tortoise habitat. The proposed pipeline route would avoid rocky slopes and outcrops where tortoises are mostly like to occur. Pataya would conduct a search for tortoises before construction.

Opuntia phaecantha spp. superbospina, a state protected cactus which occurs at the southern end of the pipeline route, could be impacted by construction. The Arizona Native Plant Law requires that the applicant notify the Arizona Commission of Agriculture and Horticulture at least 30 days before removing or destroying protected plants. After notification, the state reviews the project's anticipated effect on protected plants and may recommend measures to minimize their destruction.

F. LAND USE, RECREATION, AND AESTHETICS

Most of the project components would have no significant direct effect on land use in Hualapai Valley. The area of land removed from grazing--the principal land use--would support less than 1 cow. The potential for designating Red Lake a natural area might be impaired, but the project would probably not directly decrease the lake's value for scientific study unless the playa were contaminated by salt.

However, constructing the access roads would have various impacts which could be considerable. The proposed 30-foot wide all-weather access road from Antares Road would parallel ranch fences, abut a water tank and corral, and, according to a local rancher, cross one of the more productive range sites in the valley. If the road were constructed along this route, traffic might cause cattle to crowd the fence corners, injuring cattle which stepped onto the guard. While a more southern alignment would alleviate this potential problem, it would not alleviate the more significant problem of having the road placed between the pasture and the corral area. The substantial truck traffic expected during construction would interfere with the use of the corral and water tank. Traffic using the road during operation of the plant site would have a less severe but longer term impact. In addition, the proposed route would have no bends to reduce the visual intrusion and help to preserve the natural character of the landscape. (See figure 29.)

At least one alternative route is possible that would both alleviate these problems and not significantly change the length of the road. Instead of heading due east to Antares Road from the plant site, the road could head east from the plant site for 1 mile, then northeast across section 22, returning by an easterly course to Antares Road. This would avoid conflicts with ranching and reduce the linear appearance of the road, although relatively high-quality rangeland would still be crossed. This route would be approximately 300 feet shorter than the proposed route. An additional mile would be added to the total distance between the plant site and Kingman, although the trip would be 1 mile shorter from Dolan Springs. BLM officials believe there are additional alternatives with similar benefits. The environmental staff recommends that an alternative route be selected which would reduce land use and aesthetic impacts and be agreeable to BLM, existing property owners, and the applicant. Since the access road would cross Federal land, Pataya must obtain a right-of-way grant from BLM.

Mohave County officials expressed an interest in having Pataya construct the road 84 feet wide instead of 30 feet wide, as proposed.[1/] This would allow public access to adjacent subdivided land and would presumably expedite its development. However, the lack of power, water, and septic utilities would continue to limit development. Because of this, the staff believes that the additional land, gravel, and cost to the applicant required to widen the road would not be justified.

Constructing the construction access road from Stockton Hill Road would not have significant land use impacts if the roadbed were merely graded, as proposed. Aesthetic impact should be

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1/ Mohave County Planning and Zoning Commission, telephone conversation with Commission staff, June 4, 1982.

mitigated by designing appropriate bends in the road to reduce its linear appearance. (See chapter 5.) However, the applicant may be planning to engineer the roadbed for all-weather access, since surface and subsurface conditions, particularly in the vicinity of Truxton Wash, would prohibit passage of heavy wheeled vehicles during and after heavy rain. This would involve raising the roadbed with gravel 1 to 3 feet above ground level, depending on the location, and installing culverts at the principal drainages where the road crosses the floodplain of Truxton Wash. Such an access road might prevent construction delays due to inclement weather, although other areas of the project site would have similar problems when wet. It would also provide the shortest route to the plant site from the proposed gravel pit. After construction is completed, the road would not be needed.

The staff believes that constructing such an all-weather temporary access road would be environmentally disruptive and unwarranted. The 1- to 2-mile wide braided fluvial bed of Truxton Wash is subject to periodic flooding and is therefore a floodplain. Executive Order 11988, Floodplain Management, requires Federal agencies to "consider alternatives to avoid adverse effects and incompatible development in the floodplains" and, if the floodplain is found by the head of the permitting agency to be the only feasible site, to "design or modify its action in order to minimize potential harm to or within the floodplain." It would not be possible to ensure that this road is constructed compatibly with the floodplain. Although culverts could be installed at the numerous existing drainages of the floodplain, these braided drainages characteristically change course over time. When such changes occur, the road could partially dam the wash and alter the character of the floodplain. Second, the probable 100-year flood level of Truxton Wash is unknown. While there is no evidence of recent high flood levels, a record flood upstream near Hackberry, reported in 1904, may have caused substantial flooding at the proposed road crossing. Because the road may not be designed to accommodate the 100-year flood level, such flooding could damage the road.

The principal use of this road would be to haul gravel from the pit site to the plant site, the other all-weather access road, and the evaporation pond. The staff believes there are two reasonable alternatives to engineering this road for all-weather access. Tracked vehicles could haul gravel during inclement weather or if subsurface conditions made the use of trucks impossible. Tracked vehicles spread the total vehicle weight over a much larger area than wheeled vehicles and can therefore operate in soils with lower weight-bearing capacity. The second alternative would be to drive north on Stockton Hill Road from the gravel pit to section 5, where Stockton Hill road abuts the playa. From there, vehicles could cross the playa to the construction sites. This would increase the trip by about 6 miles. However, it would avoid constructing a permanent road for temporary use. Both alternatives would subject the applicant to brief construction delays because of the difficulty in operating

vehicles when the native soils are wet. However, rains are usually brief, and the playa dries rapidly. Based on climatic records, the staff would not expect more than 8 weeks of potential delay per year. If construction had to proceed during inclement weather, access could be gained using the proposed all-weather road from Antares Road, although this would involve a substantial round-trip.

In conclusion, the environmental staff believes that the permanent impact of an all-weather access road on the floodplain of Truxton Wash and the increased aesthetic impact of a raised gravel road far outweigh any short-term convenience it might provide during construction of this project; it therefore recommends that construction of this access road be limited to smoothing the roadbed at grade.

Construction of the proposed facilities would be quite noticeable because the dust generated by numerous cars, trucks, earth-moving vehicles and other equipment would be carried by the wind. This impact would last approximately 2 years.

Following construction, the gas storage facility and evaporation pond would be visible. Encompassing 20 acres, the storage facility would include several buildings, small tanks, aboveground fresh water storage pond and process piping. Because of its small size relative to the valley and its distance from the roads, the facility would probably not ruin the aesthetic quality of the valley, but it would still be noticeable and, to some people, it might be an eyesore. Pataya could reduce the aesthetic impact by painting the facility in soft desert tones, which would camouflage the structure to some degree. All water and gas pipelines would be buried. The evaporation pond, on the other hand, would be quite noticeable because of its larger size. The applicant has not stated how long it would retain the pond, but presumably it would want it intact for some time after completion of the project to facilitate the construction of additional caverns. Although it would be desirable aesthetically to remove the rip-rap and level the pond immediately after construction, as a practical matter, the pond should be retained for a period that would balance the economic use of the structure, its serviceable life, and the aesthetic quality of this scenic valley. Therefore, the staff recommends that within 2 years after the proposed caverns are in service, the applicant must establish a schedule for ultimate removal of all of the produced salt and restoration of the pond site to its former condition.

To further minimize long-term aesthetic impact, excess soil that would be excavated during the construction of facility foundations should be removed from the area and disposed of in the proposed gravel pit.

Because of the duration of construction, the size of the work force, and the nearly constant wind, litter could become an unsightly problem if no provisions were made for proper disposal of trash. Like any construction project of this kind, trash receptacles should be provided at the major work sites and emptied regularly. After construction is completed, the project area should be scouted to remove any remaining litter and debris. According to John Clark of the Mohave County Health Department, Pataya could use the county landfill to dispose of trash and light construction debris. The proposed gravel pit should not be used for this purpose.

Approval of the project would allow the applicant to seek condemnation of section 13, part of the evaporation pond, under its right of eminent domain. This section is currently owned by Mayland Properties, Incorporated, and an unknown private party.

The project would have very little effect on hunting, rock collecting, off-road vehicle driving, camping, or picnicking. However, its effect on the visual quality of the valley could affect sightseeing. The project's effect on the use of Red Lake for landsailing is speculative. Currently, CWC will not allow landsailers to use the lake. If the project is not approved, CWC could elect to retain its land, thereby maintaining the status quo, or it could sell the land, thereby opening the possibility of landsailing there.

The project could have an indirect effect which would change land use in the valley substantially. This effect might be the construction of additional industrial facilities which would use the salt deposit. Because of the uncertainty of regulatory approval of additional caverns, it is doubtful that salt-related industries would be established to process salt produced by gas storage cavern construction alone. Nevertheless, CER Corporation, Pataya's engineering consultant, projects as an extension of this project an industrial complex in the area with compressed air energy storage, related salt/chlorine-based chemical plants, and other industries using salt storage caverns. Given BLM's interest in exchanging Federal land in this area for private land elsewhere, CWC's extensive land ownership in the area, its expected ownership of the underlying salt body in several sections, and Mohave County's interest in promoting industrial growth, these plans may be realized. Also, CWC may be planning to construct a golf course and airstrip near Red Lake, which would make the area somewhat more attractive. If the proposed project were approved, it could accelerate such industrial development in the valley. If additional industrial facilities were constructed as an indirect result of this project, the aesthetic and other impacts would, of course, be much greater than those from the proposed project.

G. SOCIOECONOMICS

1. Facility Construction and Operation

Approximately 550 employment positions would be filled during construction of the proposed project. The gas storage facility construction would employ 270 workers. Midway through the 33-month long construction period, the natural gas pipeline would be installed by 280 workers. The major labor-intensive construction, illustrated in figure 30, would occur over the first 23 months.

Kingman has 39 motels with over 1,400 rooms; this should be adequate to absorb transient workers. The workers' occupation of these facilities would deny them to the tourist trade for the duration of construction. After construction, most of the workers would leave the area. Only 8 to 12 people would operate the facility, confining the basic socioeconomic impact to the construction period.

Within the Kingman area, about 532 individuals are employed in the construction industry, while 40 currently unemployed individuals have experience in the construction trades. It is unlikely that a significant proportion of the local workers are skilled in such trades as welding and heavy equipment operation, which the project would require, so most of the workers would have to be recruited elsewhere.

Payroll for the total construction work force should be about $825,000 per month, assuming an average wage of $1,500 per month per employee and a total work force of 550.

According to an employment multiplier of 2.18 developed by the Mohave County Planning and Zoning Commission, an average of 300 project workers would generate 354 other jobs in the area. This would reduce the area's unemployment, which was approximately 1,100 during 1979.

School enrollment for Kingman dropped from 6,059 in 1977 to 5,445 in 1979, leaving enough extra capacity for the children of transient worker families. There are four public elementary and junior high schools in Kingman and three high schools.

The Arizona revised statutes have set a 38-percent assessment ratio for utility properties in 1985, when the proposed project would be completed. Given a total estimated project cost of $54.3 million, the Pataya property should then have an assessed value of about $20.6 million. The average 1981 *ad valorem* property tax rate on Pataya's current property in Mohave County was $9 per $100 of assessed value. If this tax rate applies in 1985, the Pataya property tax that year would be about $1.9 million. Pataya estimates that the tax rate of $9 per $100 of assessed value will

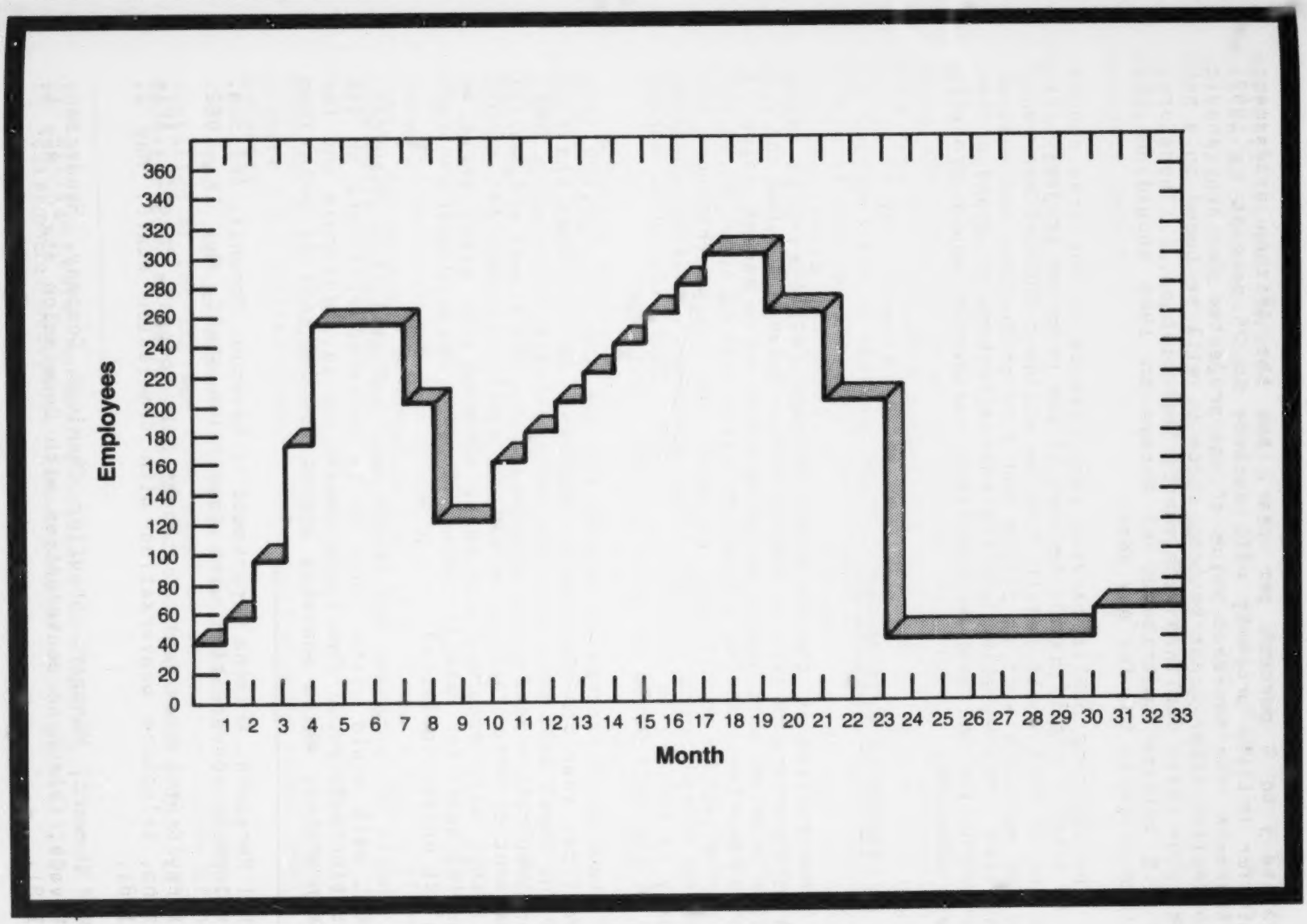

Figure 30
Construction Employment Schedule

escalate 3 to 4 percent per year, but the Arizona assessment ratio for utility property will decline to 25 percent by 1992. Furthermore, the assessed value of the projected facility should also decline after construction, since it will be based on a net book value which declines with yearly depreciation.[1/] Therefore, the $1.9 million contributed by Pataya in 1985 should be its maximum property tax for any year.

The existing public service requirements of the area should not be altered significantly because of the proposed project. Exceptions to this could result from an accident-induced emergency need for services such as police and fire protection and medical facilities. The existing utility infrastructure of areas chosen by construction workers as temporary residences would probably remain adequate.

2. Impact on Salt Market

Construction of the proposed storage facility would bring 1.54 million tons of salt to the surface. Between 400,000 and 1.2 million tons of salt would be harvestable at a market value of about $4 per ton. Adding a transportation cost of about $0.09 per ton per mile, it should cost about $9 per ton to transport the salt 100 miles to its nearest large consumer, Stauffer Chemical Company (Stauffer) in Henderson, Nevada. Thus, the total market cost of the salt would be about $13 per ton.[2/]

Stauffer is currently paying $17 per ton for 200,000 tons of salt per year for chlorine production. It purchases the salt from the Great Salt Lake Minerals and Chemicals Corporation (GSL) solar evaporation pond plant in Ogden, Utah. The miners and capital investment at this facility would be negatively impacted should the Pataya salt displace its salt, although GSL might serve as marketing agent for Pataya's salt. Stauffer has a 10-year contract with GSL ending in 1985.[3/]

Should GSL purchase the Pataya salt and sell it to Stauffer, the GSL salt would either have to be marketed elsewhere or its production deferred. One large market is in California and the western states, which annually import 500,000 tons of salt from

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1/ Hal Ferguson, Arizona Department of Revenue, Phoenix, Arizona, telephone conversation with Commission staff, May 12, 1982.

2/ Jerry Grott, President, Southwest Salt Company, Phoenix, Arizona, telephone conversation with Commission staff, May 1, 1981.

3/ T. Stewart, Manager, Stauffer Chemical Company, Henderson, Nevada, telephone conversation with Commission staff, May 4, 1981.

Mexico.1/ Local markets would also be strongly impacted. For instance, Southwest Salt Company (Southwest Salt) in Phoenix sells 32,000 tons of salt annually at about $24 per ton delivered. This is more than the $17-per-ton price of the GSL salt. Southwest Salt could lose business should the Pataya project be completed. Construction of more caverns in the future could exacerbate the economic impact.

H. NOISE QUALITY

The Noise Control Act of 1972 assigns the primary responsibility for noise control to state and local governments, with assistance and guidance from the Federal Government. In response to this act, EPA published guidelines in March 1974, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," which evaluate the effect of various levels of environmental noise. EPA emphasizes that the levels discussed in the document should not be interpreted as a Federal ambient noise standard, since they consider neither cost nor technical feasibility. Rather, the guidelines provide information for state and local governments to use in developing their own ambient noise standards. These levels are summarized in table 11. There are no state regulations governing noise emissions during construction or operation of the proposed project.

Pipeline construction and site preparation would temporarily affect noise quality. The specific noise emitted would depend on the equipment involved; the impact would depend on the location of the potential receptors. Noise levels from construction machinery would be typical of those associated with shallow excavation and earthmoving operations. Typical noise levels for the various kinds of construction equipment to be used are presented in table 14. Typical noise levels attributable to a construction spread are about 70 dB(A) at 250 feet from the pipeline and 60 dB(A) at 2,500 feet. Any receptor adjacent to the right-of-way would be affected only while the spread was working in the area.

If difficult excavation conditions were encountered along the proposed right-of-way, controlled blasting might be required to prepare the pipeline trench. This would elevate sound levels temporarily.

The 5,400 horsepower of compression and electrical generators installed at the storage site would be the major source of noise emissions during project operation. The applicant has not provided

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1/ William Lewis, Marketing Manager, Leslie Salt Company, Newark, California, telephone conversation with Commission staff, May 1, 1981.

TABLE 14

TYPICAL PIPELINE CONSTRUCTION EQUIPMENT
NOISE LEVELS

Equipment	dB(A) At 50 Feet
Backhoe	80-92
Bulldozer	82-95
Ditching Machine	80-90
Motor Crane	78-87
Backfiller	82-95
Welding Rig	72-82
Air Compressor	85-91
Jack Hammer	88-98
Trucks (Heavy Duty)	82-92
Pickup Trucks	70-85
Automobile	65-76
Grader	80-94
Generator	71-82

the Commission with sound spectrum data for either the three reciprocating compressor units or the electrical generators that are proposed. However, Pataya states that a 5-dB(A) increase could be expected at the plant property line when gas compression begins. Assuming an L_{eq} of 40 dB(A) as a background, the noise with all compressor units operating would be equivalent to an L_{eq} of 45 dB(A) and an L_{dn} of 50 dB(A) at the plant boundary. This noise level does not include noise emissions generated by the electrical generator(s) or injection pump drives. Nevertheless, the nearest residence, about 10 miles away to the southwest, would experience no acoustical impact. The additional noise generated by the electrical generators and injection pump drives would blend into background noise levels and not be perceived over the ambient noise levels. Furthermore, there is a natural noise barrier, a rocky promontory, between the nearest residence and the proposed project site. This natural barrier would reduce the noise levels further.

I. CULTURAL RESOURCES

Construction and operation of both the plant and the associated pipelines would have no adverse impact upon National Register or eligible properties. The eligibility of the 22 properties identified by WESTEC was based on the information that these sites could provide about the history and prehistory of the area. That information has been extracted through WESTEC's data recovery program, thereby negating the potentially adverse impact of the

proposed facility. The field work was completed between February 3 and February 21, 1982, under the authority of the Department of the Interior Antiquities Act Permit No. 81-AZ-180. Analysis of the data collected is in progress. Preliminary and final reports will be forthcoming.

WESTEC's data recovery program at these 22 sites consisted of both intensive and representative sampling. All 22 sites were mapped to include elevation contours and artifact and feature locations. Total surface collections were made at 14 of the sites. Subsurface excavations 1 meter square were conducted at seven sites. Six sites contained specific artifact classes or features and were considered important in identifying cultural affinity and chronology. At these sites, specific artifacts were collected for further analysis. Column soil samples were taken from each of the sites where subsurface excavation units were placed. Samples were also taken from hearth areas and from all other features and artifacts thought to contain information about past floral communities or plant/animal use by aboriginal inhabitants. The data recovery program was approved by the Advisory Council on Historic Preservation. (See appendix E.)

The appropriate consultation was accomplished with the Arizona State Historic Preservation Officer. He concurred with the Commission on its determination that the 22 sites in question were eligible for the National Register of Historic Places and on its determination of no adverse effect to the eligible properties by virtue of the data recovery program proposed by WESTEC.

J. PIPELINE AND PLANT SAFETY

Transportation of natural gas by pipeline involves the risk of an accident and subsequent loss of gas. For natural gas, the greatest hazard is an explosion or fire following the rupture of a pipeline.

Construction of the 30 miles of 16-inch diameter pipeline would conform to the safety requirements of the DOT--including minimum burial depth (depending upon local jurisdiction) and block valve spacing. These requirements are intended to ensure adequate protection from catastrophic pipeline failures. DOT requirements also include minimum material design requirements for piping components, corrosion control, testing requirements, and provisions for operation and maintenance.

Area classification (i.e., population density within 220 yards on either side of the centerline of any continuous 1-mile long section of pipeline) determines additional safety measures--such as pipeline wall thickness, pipeline yield strength, and maximum design operating pressure--which must be incorporated during design and construction of all natural gas pipelines. In addition, special installation procedures must be followed at

railroad and highway crossings. Other safety requirements deal with compressor station design. These design features take into account building design, location, site layout, and emergency shutdown systems that must be integrated into the design of each compressor station.

From 1970 to 1979, there were 3,609 reportable service incidents on 305,355 miles of natural gas transmission and gathering pipelines. The average number of incidents over the 9 years was 401 incidents per year; the maximum was 471, the minimum 255. In addition to the service failures, 1,797 test failures were reported. The test failures, however, remove defects from pipelines before service failures occur; hence, these failures contribute to the overall safety of natural gas pipelines. Independent calculations predict a mean accident rate of 1.4 incidents per 1,000 miles of pipe per year for the natural gas industry. Since the project would require only 30 miles of 16-inch diameter pipeline, 0.042 incident per year could be expected (one in 24 years).

Outside force incidents, the leading type of pipeline incidents, are caused by the encroachment of mechanical equipment such as bulldozers and backhoes, from earth movement such as soil settlement or washouts and other geologic hazards, from weathering effects such as thermal strains, and from sabotage. None of these reflect faults in the pipeline design or in operation or maintenance procedures.

Except in rare instances, the rapid isolation and shutdown of a ruptured or leaking transmission pipeline is necessary to eliminate a combustible gas, to prevent wasting a valuable resource, and to begin restoring the pipeline to its normal operating condition. The applicant has not identified the detailed procedures that its maintenance staff would follow to ensure proper isolation of a pipeline rupture or leak. However, the normal sequential procedures include detection of a rupture, shutdown of the pipeline, location of the rupture, repair of the rupture, testing, and resumption of operation. The detection of a pipeline rupture would be signaled to the monitoring personnel in Las Vegas or at the plant site by the differential gas flow measurements detected at either end of the pipeline. Pataya proposes to install three block valves on the proposed pipeline. One valve would be installed at either end, while the other would be installed in the middle.

The major safety hazard of a natural gas transmission pipeline is a rupture. If a rupture occurred without the gas igniting, the escaping natural gas would disperse quite rapidly because it is lighter than air. If gas ignition occurred without an explosion, the ruptured pipeline would merely act as a flare and would endanger only nearby structures. An explosion (i.e., physical explosion resulting from a pipeline rupture) would create the greatest hazard to the surrounding structures, equipment, and people within the immediate vicinity.

TABLE 15

POTENTIAL GAS LOSS FROM PATAYA PIPELINE RUPTURE

	Line Loss From Rupture (Line Pack)	Loss Before Detection (Mcf)		Loss Between Detection and Isolation (Mcf)	Total Loss (Mcf)
Injection (54.94 million cfd)	5,573 Mcf	1 Hour	74.73	194	5,841
		2 Hours	149.46		5,916
		3 Hours	224.19		5,991
		4 Hours	298.92		6,066
Withdrawal (100 million cfd)	7,190 Mcf	1 Hour	74.73	194	7,459
		2 Hours	149.46		7,533
		3 Hours	224.19		7,608
		4 Hours	298.92		7,683

If a pipeline rupture occurred, the volumes of gas lost would be a function of the pipeline operating pressure at the point of the rupture and the response time necessary to detect, locate, and isolate the ruptured segment of pipe. The applicant has stated that there is no way to estimate the volumes of gas that could be lost because of a pipeline leak or rupture. The environmental staff agrees that there is an infinite variety of conditions and circumstances that could occur. However, the staff has assumed a rupture of 5 square inches, along with the proposed operating parameters for gas injection and withdrawal, to calculate potential volumes of gas loss (table 15).

The compressor station would be remotely controlled with microwave switching units at the Southwest control center in Las Vegas. Plant personnel would have complete override control to respond to an onsite emergency. In the event of a control panel failure, all compressor units could be shut down at the individual control panels on each unit. The basic operating philosophy for the station would be steady-state flow control with provisions for pressure override when in the injection and withdrawal modes.

The equipment used for the injection process would include a filter separation unit, metering units (for measuring total stream and individual well flow), compressors, and a heat exchanger for gas cooling. Safety controls for the filter separation unit would include liquid level controllers, a differential pressure alarm, overpressurization relief valve, and a two-stage liquid level alarm. All design, construction, operation, and emergency procedures would conform to 49 CFR 192 requirements. In addition, the gas vent stack of the hydrocarbon storage tank would be equipped with a flow switch designed to alarm when excessive venting occurred. The equipment used for the withdrawal process would include metering devices (at wells and plant exit), process heater, pressure regulator, flow regulator, and a dehydration unit. The pressure regulators and flow control valves would be monitored at the plant's main control panel.

The onsite fire protection system would consist of eight fire hydrants. Each hydrant would have a gate shutoff mechanical joint with a breakaway feature at the base, designed to fail and separate without damage to the other hydrant parts, in the event of a collision. The maximum spacing of the hydrants within the plant would not exceed 300 feet. Each hydrant would be supplied with a hose house in which 200 feet of hose, a wrench, and connectors would be placed. The fire system would be designed with loop piping, a valve, and drain at each hydrant. A minimum constant pressure of 75 psi would be maintained in all lines.

The water for the firefighting system would be supplied from the plant's freshwater reservoir and water well system. The reservoir--an earthern, inground, lined tank--would be located near the fire pump. A minimum of 50,000 gallons of water would be kept in

this pond at all times. An electric motor-driven pump would be installed and connected to the plant's main power system and to a diesel fuel-driven auxiliary generator in the equipment bay of the central control building.

If the main power and auxiliary power failed, a portable diesel generator with fuel tanks would be on or near the site. This generator would be designed for use during construction and periodic plant maintenance, but it would be adequate to operate the firewater pump.

Fire extinguishers would be placed in all structures in accordance with the current safety standards. Plant personnel would be familiar with the operation and location of the firefighting equipment but would not be trained as firefighters. In the event of an emergency, a communications link with the Kingman fire department would be activated.

The emergency shutdown system would be designed to isolate and purge the plant and all station piping within 3 minutes of an emergency shutdown (ESD) signal from the remote control center or at the plant site. The ESD would be manually activated when the plant operator was alerted by visual alarms. The plant would automatically shut down for hazard alarms such as fire, ultraviolet flame detection, gas detection, and a wellhead failure. All gas purged from the plant would be piped to a single stack and flared.

For each storage well, a high-pressure gas wellhead valve would be installed. In addition, a downhole ESD system (blowout preventer) would be installed in the well just above the cavern. This system would consist of two sets of shutdown valves, one above the other. One of the valves would be an automatic ESD which would activate as soon as an anomalous pressure surge were registered. The other valve would have the same function but would be operated manually and would be used only if the automatic system failed. These systems would be available to isolate the cavern gas. The gas above the ESD system would flow past the wellhead through the meter house to the gas flare where it would be ignited. The gas lost from the storage cavern upon automatic closure would be insignificant. The volume of gas lost by manual closure would depend on the reaction time of the plant personnel.

The giant desiccation cracks discussed in section 3.C.2 could present operational and maintenance problems if new fissures formed. The distribution of recent fissures suggests that cracks could form across the access roads and pipelines and present a possible safety hazard to unwary vehicle operators.

CHAPTER FIVE
CONCLUSIONS AND RECOMMENDATIONS

Information provided by the applicant and developed by the environmental staff from field investigations, literature research, and contacts with Federal, state, and local agencies indicates that, with certain conditions, the construction and operation of the proposed Red Lake Salt Cavern Gas Storage System would have limited adverse environmental impact. Therefore, the staff of the Environmental Evaluation Branch believes that, with implementation of the recommended monitoring programs and other mitigating measures identified later in this chapter, the proposed project would be environmentally acceptable.

Fugitive dust generation could be a severe problem during construction, but no major long-term impact would occur. Dust generation would be controlled by wetting and yearly magnesium chloride road treatments. Air emissions from the proposed compressors would be a major source of nitrogen oxides. The applicant must apply to EPA for a PSD applicability determination. If the EPA determines that the proposed plant would be a new major emitting source, Pataya would be required to apply the best available control technology to reduce pollutant concentrations.

Topographic changes associated with the evaporation pond, borrow pits, and cavern site would be readily apparent because of the level character of the terrain. The proposed pond abandonment scheme would result in minimal long-term impact. Possible ground surface subsidence at the cavern site would cause permanent though probably minor topographic changes. Subsidence at the water well area could effectively increase the size of the playa and subject the area to periodic inundation.

Analysis of the preliminary design of the cavern system indicates that structural stability would not be a problem. Information on the mechanical properties of the salt has been derived from analyses of samples taken from a nearby well. Since the mechanical properties of salt can vary considerably over short distances, samples from the actual cavern sites must be obtained and analyzed. Until further site-specific data are available, it cannot be concluded with certainty that the proposed site is suitable.

The soils in the project area have a low productivity, and conditions are not conducive to agriculture. Soil engineering conditions on the playa are generally acceptable for pond construction, although optimum moisture content and compaction may be difficult to achieve. Qualified soils engineers should be retained

to monitor soil conditions during construction. Soil desiccation might limit extended use of the evaporation pond; however, the proposed pond design should be adequate for the proposed project. Soils at the plant site and along portions of the proposed access road are unsuitable and would have to be replaced with engineered fill. The required volumes of fill can be obtained from alluvial deposits in sections 19 and 29, T.26N., R.17W. Proper drainage on the plant site is an important consideration for foundation stability.

Aquifer pumping tests indicate that sufficient well yields for the proposed uses could be developed in the area of section 23, T.26N., R.17W., immediately south of the lakebed. Water level changes computed on the basis of these tests indicate that the proposed rate of withdrawal would cause relatively minor water level declines over a rather substantial area of the valley. Continuing withdrawals, which would occur if additional caverns were constructed, are likely to produce more pronounced effects. Annual withdrawal rates in the area already exceed the estimated recharge into the groundwater system.

Current understanding of the giant mud crack phenomenon is not adequate to predict when and where future cracks will appear. The process is related to deep-seated desiccation resulting from a long-term decline in the level of the groundwater. Therefore, large-scale groundwater withdrawals in the area could accelerate the cracking. Cracks that form across access roads or pipelines could cause operational and maintenance problems. If new fissures developed in the evaporation pond, brine could be lost and groundwater could be contaminated. Periodic monitoring of a system of aquifer observation wells and surface movement indicators during construction, as recommended, would provide the data necessary to assess the effects on groundwater resources, to determine if there is a causal relationship between groundwater withdrawl and giant crack formation, and to develop more precise background data for environmental review of future expansions or necessary remedial measures.

Some loss of vegetation and wildlife habitat would be unavoidable. Natural revegetation is typically slow in arid regions. Construction is likely to cause some direct mortality of small mammals, reptiles, and possibly nesting birds. Additional preconstruction surveys would allow avoidance of state listed endangered or threatened species. No federally listed or proposed endangered or threatened species would be affected.

The proposed land use is consistent with county, state, and Federal goals and policy. There would be little effect on the common recreational opportunities in the area.

The plant would create a noticeable, though not severe, aesthetic impact. Constructing the access road from Stockton Hill Road to the plant site to all-weather specifications would create a significant long-term aesthetic impact.

The socioeconomic effects are likely to be minor and more beneficial than adverse, though the local salt market might be strongly affected.

Construction noise impact would be temporary; operational noise impact would be very minor.

There would be no impact to cultural resources from construction and operation of the proposed project. A data recovery program has been completed, and 22 sites have been found to be eligible for the National Register of Historic Places. (See appendix E.)

Safety hazards would be minimized by applying appropriate engineering and fire protection technology. The Arizona Mining Board must issue certificates of safety training for mining personnel. A direct communications link with the Kingman Fire Department would be established.

The BLM has conducted an independent environmental assessment of the proposed pipeline route, and the applicant has been granted the necessary right-of-way across Federal lands. BLM's recommendations are included in appendix A of this EIS.

The BLM is currently reviewing a right-of-way request from the applicant for an 11-mile long roadway which would provide all-weather access to the plant site from both sides of Hualapai Valley. The 6-mile long western segment, connecting the plant site to Stockton Hill Road, would require more than 50,000 cubic yards of engineered fill and drainage provisions in the floodplain of Truxton Wash to support the weight of five-axle propane delivery trucks. The environmental staff believes that the proposed single all-weather access road connecting the plant site with Antares Road on the east side of the valley would be less disruptive. The western segment between the plant site and Stockton Hill Road should be constructed at grade and not used during wet periods, as originally proposed.

The following recommendations should be included as conditions to the certificate to further mitigate the environmental impact of the proposed project.

1. The applicant shall submit the following cavern design and construction data as they become available:

   a) A copy of each well log run on the solution mining wells, including drillers' and lithologic logs;

   b) Well completion records;

c) Results of mechanical, physical, and chemical analyses of salt cores (and overburden, if conducted);

d) Results of finite element modeling study of cavern stability, if conducted;

e) Results of solution mining well pressure tests;

f) Results of downhole sonar surveys;

g) Results of cavern tightness tests.

2. Pataya shall submit post-certificate construction and operational reports semiannually, within 45 days after each period ending December 31 and June 30, describing (1) facility design changes, modifications, and reasons therefor and (2) abnormal operating experiences or behavior for the period covered. Abnormalities shall include, but not be limited to equipment malfunctions or failures, nonscheduled maintenance (and reasons therefor), higher than predicted water requirements, damaging seismic activity or ground failures, and brine pond failures, including fissure formation and excessive seepage.

Within 2 years after beginning gas storage operations in the proposed caverns, the applicant shall include in its semiannual report a definite timetable for ultimate removal of all of the produced salt and restoration of the pond site. Subsequent reports shall contain information on the status of the salt harvesting operation.

The technical information submitted shall be in sufficient detail to allow a complete understanding of such events consistent with the existing state-of-the-art knowledge. If an abnormality sufficient to endanger the facility or operating personnel occurs, the Commission shall be notified immediately.

3. A groundwater monitoring program shall be implemented following certification and continued as outlined below until all of the salt has been harvested and abandonment of the evaporation pond is completed.

The applicant shall keep records on the primary water supply wells (CER-3, CER-4, NEAL-1), documenting their use. Data shall include the period of operation of each well, average

flow rate, and total volume withdrawn. Water level measurements and water quality analyses (major ionic constituents and total dissolved solids) shall be conducted monthly for the first year after certification, quarterly during cavern development, then semiannually until the evaporation ponds are abandoned and all of the salt has been removed.

Wells CER-1, CER-2, and NEAL-2 shall be used as observation wells. Three additional aquifer observation wells shall be constructed to the north of the pond site: one in SW1/4 SW1/4 sec.7, T.26N., R.16W., one in SE1/4 SW1/4 sec.12, T.26N., R.17W., and one in SW1/4 SE1/4 sec.11, T.26.N., R.17W., unless the applicant can justify through testing alternative locations or fewer wells. Quarterly and semiannual water level and water quality analyses from the observation wells shall be conducted according to the same schedule as the water supply wells.

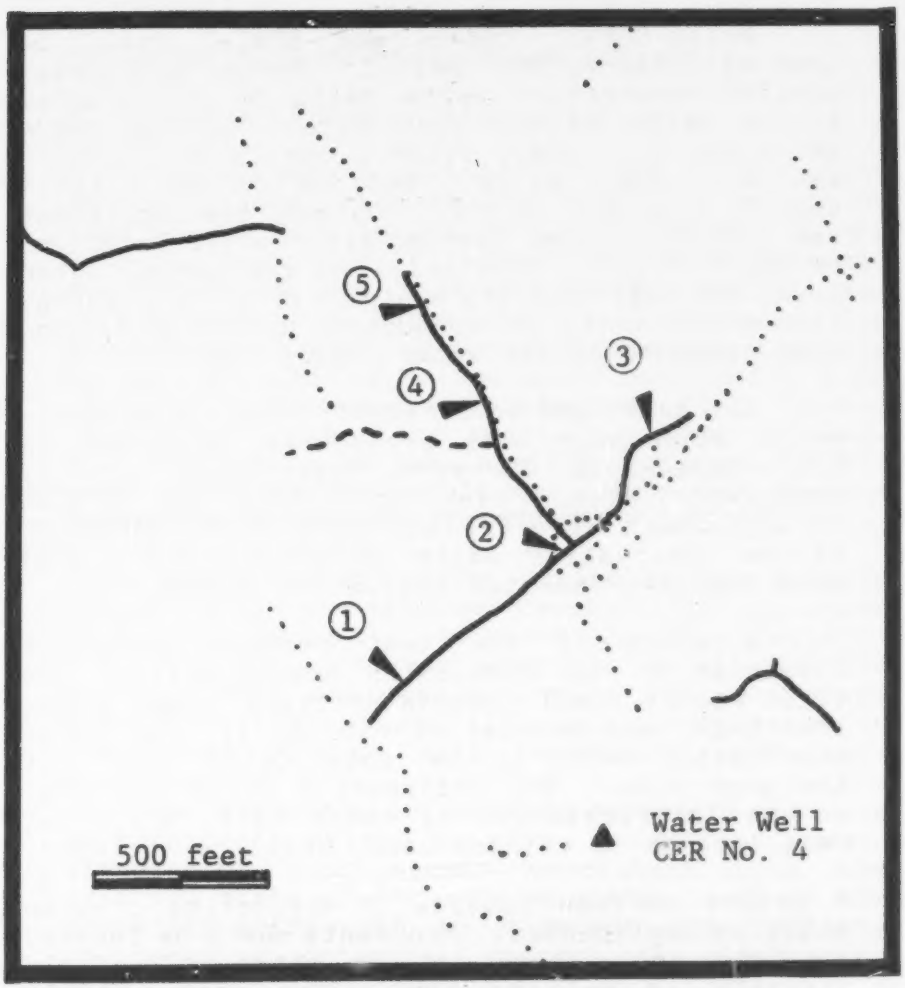
All tests and measurements shall be conducted in accordance with procedures described in U.S. Geological Survey's National Handbook of Recommended Methods for Water-Data Acquisition or equivalent industry standards. Construction of the observation wells should be coordinated with the Environmental Evaluation Branch.

A report of the test results shall be submitted to the Commission semiannually. The first report shall contain drillers' logs, electric logs, and completion records for the three observation wells to be constructed north of the pond site. Any information which may bear on the interpretation of these data, including descriptions of methods used, shall be included.

4. A ground surface subsidence monitoring program shall be implemented. Monuments shall be located such that subsidence in the water well field vicinity, as well as the cavern site, can be monitored. This network shall be resurveyed to first-order precision quarterly during cavern development and annually thereafter. Results shall be included in semiannual reports. A description of the network and all pertinent explanatory data shall appear in the first report.

5. The applicant shall install five extensometers, or equivalent devices, at the locations shown on the following diagram, adapted from figure 15. Displacement readings shall be taken monthly and

included in semiannual reports. This program shall begin upon certification and continue until all of the salt has been harvested and the evaporation pond abandonment is completed. A complete description of the installations shall be included in the first semiannual report.



6. The applicant shall conduct and submit an aerial photographic survey of the project area approximately 1 year after beginning construction of the proposed caverns. Imagery shall be in color or color infrared of the same area photographed in December 1981 and at a scale no smaller than 1:6,000.

7. Any brine or salt which spills outside the evaporation pond or salt cleaning and storage area shall be removed.

8. Once a site is selected for the communications tower, the applicant shall submit the pertinent details of the installation for staff review before construction begins.

9. The applicant shall consult with the Arizona Department of Game and Fish to establish a mitigation plan if significant waterfowl mortality is noted at the evaporation pond.

10. Where vegetated soil exists, the top 8 to 12 inches of soil excavated from the borrow pits shall be stockpiled to provide a natural source for vegetative rehabilitation. All excess soil and rock shall be disposed of in the borrow pit excavations and covered with the stockpiled top soil; the site(s) shall then be restored to blend in with the natural topography.

11. To ensure quality control during construction of the brine evaporation pond, the applicant shall retain a qualified soils engineer or engineering geologist to perform any necessary additional tests in order to finalize the design and construction plans of the dikes and pond floor and to monitor their construction. The dikes, cutoff wall, and pond floor shall be compacted to a minimum of 90 percent relative compaction. The pond floor shall be compacted at least 9 inches deep.

12. To reduce potential long-term land use and aesthetic impact, the all-weather access road from Antares Road to the plant site shall be constructed along an alternative route (such as the one discussed in section 4.F of the EIS) that is acceptable to existing land users, the applicant, and BLM. The construction access road from Stockton Hill Road to the plant site shall be constructed at the existing grade, and no engineered fill shall be used. The alignment of this road shall include minor bends to reduce its aesthetic impact.

13. The applicant shall apply to EPA's Region IX for a PSD applicability determination for the proposed plant.

14. The applicant shall comply with the following BLM Terms and Conditions of Grant on private land as well as on Federal land:

> The Grantee shall coat all paintable above-ground appurtenances with a primer, suited to the desert environment, and shall paint same with one of the following options, unless another color meets the approval of the Kingman Resource Area Visual Resource Specialist [of the BLM]:

Option No. 1 - Mohave Sage #2304 (supplied by Southwest Paint).

Option No. 2 - Olive #2323 (supplied by Southwest Paint).

Option No. 3 - Ford Gray Industrial Enamel (supplied by Deer-O-Paints).

Option No. 4 - Cholla Green Industrial Enamel (supplied by Deer-O-Paints).

> During the pipeline trenching construction activity, the Grantee shall insure that the top 8 to 12 inches of top soil is salvaged and is redistributed and compacted following the closure of the trench. Salvaging of the top 8 to 12 inches of soil will provide a natural source for vegetative rehabilitation.

> If during construction activities dust becomes a health or safety problem, the Grantee shall insure that disturbed areas are watered down or otherwise controlled with a wetting agency approved by the Area Manager, Kingman Resource Area [BLM].

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APPENDIX A
BLM RIGHT-OF-WAY GRANT AND ENVIRONMENTAL ASSESSMENT OF PROPOSED NATURAL GAS PIPELINE ROUTE

ASO Form 2880-1CL
(Rev. 11/81)

IN REPLY REFER TO
A-17002 (JLJ)
R/W (943)

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
ARIZONA STATE OFFICE
2400 VALLEY BANK CENTER
PHOENIX, ARIZONA 85073
(602) 261-4774

December 8, 1981

RECEIVED BY
JAN 1[illegible]
ENVIRONMENTAL EVALUATION
BRANCH

RECEIVED
DEC 29 1981
KINGMAN RESOURCE AREA

DECISION

RIGHT-OF-WAY GRANTED

Details of Grant

Serial Number of Grant: A-17002

Name of Grantee: Southwest Gas Corporation

Map Showing the Location and Dimensions of Grant:

Map Designations: Pataya Pipeline; Sheets 1 and 2 of 2

Date Filed: June 22, 1981

Permitted Use by Grantee: Easement for 16" O.D. natural gas pipeline, 50' width

Authority for Grant: Section 28 of the Act of February 25, 1920, as amended (30 U.S.C. 185)

Regulations Applicable to Grant:

Code Reference: 43 CFR 2880

Circular Number: 2453, as amended. 1/

BLM
PHOENIX DISTRICT
DEC 14 '81

	INIT.	ACTION	INITIAL
DIST MGR			
AST DM	3		
PA			
ADMIN			
OPER			
RES MGT	3		5
P & EC			
PRA			
LGRA			
CRA	4		

Date of Grant: December 8, 1981

Expiration Date of Grant: December 7, 2011

Rental:

Amount: To be determined by BLM appraisal

When Payable by Grantee: Upon demand.

1/ Circulars 2464, 2475 and 2476

Terms and Conditions of Grant

Pursuant to the authority vested in the undersigned officer by Bureau Order No. 701 of July 23, 1964 (29 F.R. 10526), a right-of-way, the details of which are shown above, is hereby granted, subject to the following terms and conditions:

1. All valid rights existing on the date of the grant;

2. All applicable regulations in 43 CFR 2803.1-1 and 2880;

3. The right-of-way herein granted shall be subject to the express covenant that it will be modified, adapted, or discontinued if found by the Secretary to be necessary, without liability or expense to the United States, so as not to conflict with the use and occupancy of the land for any authorized works which may be hereafter constructed thereon under the authority of the United States;

4. At least 10 days in advance of beginning construction activities on the public lands, the grantee shall submit a timetable of construction to the appropriate District Manager.

   (If construction is to begin upon receipt of the permit, the grantee shall immediately contact the District Manager to advise him of the immediate construction, and to discuss the timetable of construction.)

5. The permittee shall survey and clearly mark the centerline of the right-of-way. The exterior limits shall be clearly marked in an approved manner when required by the Authorized Officer or authorized delegate. All activities directly or indirectly associated with construction or maintenance must be conducted within the limits of the right-of-way; removal of vegetation shall be restricted to that absolutely essential to construction or maintenance;

6. The Permittee shall immediately report to the Bureau of Land Management Authorized Officer any archaeological (prehistoric and historic) or paleontological remains that are encountered during construction or maintenance, and will suspend all work in connection with the right-of-way until final archaeological or paleontological clearance is granted;

7. The Permittee shall comply with the applicable Federal and State laws and regulations concerning the use of pesticides (i.e., insecticides, herbicides, fungicides, rodenticides, and other similar substances), in all activities/operations under this permit. The Permittee shall obtain from the BLM Authorized Officer approval of a written plan prior to the use of such substances. The plan must provide the type and quantity of material to be used; the pest, insect, fungus, etc., to be controlled; the method of application; the location for storage and disposal of containers; and other information that the BLM Authorized Officer may require. The plan should be submitted no later than December 1 of any calendar year that covers the proposed

activities for the next fiscal year (i.e., December 1 deadline for the Federal fiscal year beginning the following October 1). Emergency use of pesticides may at times be neccessary; in these instances, notification shall be furnished the BLM Authorized Officer either by telephone or personal visit prior to application of the pesticide. The use of substances on or near the right-of-way shall be in accordance with the approved plan. A pesticide shall not be used if the Secretary of the Interior has prohibited its use. A pesticide shall be used only in accordance with its registered uses and within other limitations if the Secretary has imposed limitations. Pesticides shall not be permanently stored on public lands authorized for use under this permit.

8. Upon completion of construction, the lands shall be restored to as near their natural condition as possible, subject to approval by District Manager;

9. This right-of-way reserves to the Secretary of the Interior, or lawful delegate, the right to grant additional rights-of-way or permits for compatible uses over, under, or adjacent to the land involved in this grant;

10. Permittee shall take all measures necessary to protect the health and safety of all persons affected by their activities performed in connection with the construction, operation, maintenance, or termination of the right-of-way grant, and shall immediately notify the District Manager of all serious accidents which occur in connection with such activities;

11. During the construction, operation, and maintenance of this right-of-way, Permittee shall not discriminate against any employees or applicants for employment because of race, creed, color, sex or national origin and all subcontracts shall include an identical provision.

12. Permittee will comply with State standards for rights-of-way construction, operation, and maintenance of pipelines to the extent practical and to the extent that they are equal or exceed Federal standards;

13. Abandonment of a right-of-way or noncompliance with any provisions of Section 28 of the Mineral Leasing Act, as amended, or terms and conditions of this grant may be grounds for suspension or termination of the right-of-way if (a) after due notice to the holder of the right-of-way, (b) a reasonable opportunity to comply, and (c) an appropriate administrative proceeding pursuant to Title 5, United States Code, Section 554, the Authorized Officer determines that any such grant exists and that suspension or termination is justified;

14. If the Authorized Officer determines that an immediate temporary suspension of activities within a right-of-way or permit area is necessary to protect public health or safety or the environment, he may abate such activities prior to an administrative proceeding;

15. Upon construction of the right-of-way and prior to operations, Permittee shall submit to the Authorized Officer a certification of construction, verifying that the pipeline system has been constructed and tested in accordance with the terms of the right-of-way grant, and in compliance with any required plans and specifications, and applicable State and Federal laws and regulations.

16. To do everything reasonably within its power, both independently and upon request of the Authorized Officer, to prevent and suppress fires on or near the right-of-way and related facilities. This includes making available such construction and maintenance forces as may be reasonably obtained for suppression of fires.

17. Permittee shall be fully liable to the United States for any damage or injury incurred by the United States in connection with the use and occupancy of the right-of-way by the Permittee. Permittee shall be held to a standard of strict liability for any activity or facility within a right-of-way or permit area which the Authorized Officer determines prevents a foreseeable hazard or risk of damage or injury to the United States. The Permittee or its subcontractors will be held liable as a result of injury, loss of life or damage to property in connection with construction, operation, maintenance or termination of right-of-way grant. Strict liability is not imposed for damage or injury resulting primarily from an act of war or the negligence of the United States. To the extent consistent with other laws, strict liability shall extend to costs incurred by the United States for control and abatement of conditions, such as fire or oil spills, which threaten lives, property or the environment regardless of whether the threat occurs on areas that are under Federal jurisdiction. The maximum limitation shall not exceed $5,000.00 for any one event, and any liability in excess of such amount shall be determined by the ordinary rules of negligence of the jurisdiction in which the damage or injury occurred.

In any case where strict liability is imposed and the damage or injury was caused by a third party, the rules of subrogation shall apply in accordance with the laws of the jurisdiction in which the damage or injury occurred.

Permittee shall be fully liable for injuries or damages to third parties resulting from Permittee's activites or facilities on lands under Federal jurisdiction in which the damage or injury occurred.

Permittee shall fully indemnify or hold harmless the United States for liability, damage or claims arising in connection with the Permittee's use and occupancy of the right-of-way.

All owners of any interest in, and all affiliates or subsidiaries of the Permittee, except for corporate stockholders, shall be jointly and severally liable to the United States in the event that a claim cannot be satisfied by the Permittee.

The provision in this section for a remedy is not intended to limit or exclude any other remedy.

18. This right-of-way may be renewed. If renewed, the right-of-way will be subject to regulations existing at the time of renewal and such other terms and conditions deemed necessary to protect the public interest.

19. Upon demand of the BLM Authorized Officer, the holder of the right-of-way shall pay to the United States such sums as the Authorized Officer shall determine to be required to reimburse the United States for all administrative and other costs incurred directly or indirectly by the United States in monitoring the construction, operation, maintenance, and termination of this grant.

    a. The permittee will be billed for a nonreturnable post-permit payment in the Amount of $200.00 to be paid within 60 days from the date of issuance of this grant.

20. This right-of-way is issued subject to a subsequent appraisal by a qualified appraiser of the Bureau of Land Management. The permittee has agreed to pay the Bureau of Land Management, upon demand, those fees determined by appraisal to represent the fair market rental for the use of the public lands in this permit.

21. This permit is issued subject to the enclosed Civil Rights Stipulations, Form 1814-3.

22. This permit is issued subject to the enclosed Common Carrier and Limitation on Export Stipulations, signed by the permittee on June 16, 1981.

23. The Grantee shall submit an Engineering/Survey proposal outlining the procedures to be used when removing and re-establishing survey monuments and U. S. Geological Survey benchmark and elevation markers along the course of the right-of-way. The proposal shall be sent to the Branch of Cadastral Survey, Arizona State Office, 2400 Valley Bank Center, Phoenix, Arizona 85073, as well as a copy to the Area Manager, Kingman Resource Area, 2475 Beverly Avenue, Kingman, Arizona 86401. The Grantee shall obtain written approval from the Bureau of Land Management before a monument may be removed or buried.

24. If additional rights-of-way are necessary across public land for temporary uses, such as construction easements, the Grantee shall obtain a Temporary Use Permit from the Area Manager, Kingman Resource Area, Kingman, Arizona, prior to entering said lands.

25. Prior to the Grantee's entry upon the public lands or to activities related to the removal of survey monuments, the Grantee shall obtain a Notice to Proceed from the Area Manager, Kingman Resource Area, Kingman, Arizona. Said Notice shall be prepared when, in the judgement of the Area Manager, all terms and conditions of the right-of-way grant have been mutually accepted and environmental conditions are favorable with respect to the implementation of the proposed action.

26. The Grantee shall coat all paintable above-ground appurtenances with a primer, suited to the desert environment, and shall paint same with one of the following options, unless another color meets the approval of the Kingman Resource Area Visual Resource Specialist:

    Option No. 1 - Mohave Sage #2304 (supplied by Southwest Paint).

    Option No. 2 - Olive #2323 (supplied by Southwest Paint).

    Option No. 3 - Ford Gray Industrial Enamel (supplied by Deer-O-Paints).

    Option No. 4 - Cholla Green Industrial Enamel (supplied by Deer-O-Paints).

27. During the pipeline trenching construction activity, the Grantee shall insure that the top 8 to 12 inches of top soil is salvaged and is redistributed and compacted following the closure of the trench. Salvaging of the top 8 to 12 inches of soil will provide a natural source for vegetative rehabilitation.

28. The Grantee shall insure that excess subsurface soil removed during the trenching activity is removed from site. The disposal of such excess underburden shall be the reponsibility of the Grantee.

29. The Grantee shall insure that allotment fences removed from Section 34, T. 23 N., R. 16 W. through Section 16, T. 24 N., R. 16 W., from Section 10, T. 24 N., R. 16 W., and from Section 22, T. 26 N., R. 16 W. are replaced to the same standard as that prior to construction. Enclosure #1 provides a recommended guideline should new fence construction be necessary.

30. Prior to disrupting the flow in the surface water pipeline in Section 34, T. 25 N., R. 16 W., the Grantee shall obtain the approval of rancher, John Neal of Kingman, Arizona, and shall insure that the pipeline is restored to the same condition as that prior to construction.

31. If during construction activities dust becomes a health or safety problem, the Grantee shall insure that disturbed areas are watered down or otherwise controlled with a wetting agent approved by the Area Manager, Kingman Resource Area.

32. Upon completion of the project, the Kingman Resource Area will perform a compliance examination and may require the Grantee to take appropriate action or actions to repair damage to the environment as a result of the project. Should the Grantee, or their respective agents, contractors, subcontractors, or assigns fail or refuse to take said actions, the United States shall have the right, but not the obligation, to perform any or all of such actions at the sole expense of the Grantee.

Public lands affected by this right-of-way are described as follows:

T. 24 N., R.16 W., GSR Mer., Arizona
Section 10, W½W½W½;
Section 22, W½W½W½;
Section 34, W½W½SW¼.

T. 25 N., R. 16 W.,
Section 8, E½E½E½;
Section 20, E½E½E½;
Section 28, NW¼, NE¼NE¼SW¼, SE¼;
Section 34, NW¼, NE¼SW¼, SE¼.

T. 26 N., R. 16 W.,
Section 32, E½E½E½.

Mario L. Lopez
Chief, Branch of Lands and
Minerals Operations

Enclosures
Encl. 1 - Fence Instructions
Encl. 2 - Certificate of Construction
Encl. 3 - Form 1814-3
Encl. 4 - Common Carrier and Limitation on Export Stipulations

cc: Phoenix District Office, BLM

ACCEPTED FOR:

DATE:_____

Southwest Gas Corporation

By_____

154 Title

A 17002

STIPULATIONS

COMMON CARRIER

1. Pipelines shall be constructed, operated, and maintained as common carriers. The owners or operators of pipelines shall accept, convey, transport, or purchase without discrimination all oil or gas delivered to the pipeline without regard to whether such oil or gas was produced on Federal or non-Federal lands. In the case of oil or gas produced from Federal lands or from the resources on the Federal lands in the vicinity of the pipeline, the Secretary may, after a full hearing with due notice thereof to interested parties and a proper finding of facts, determine the proportionate amounts to be accepted, conveyed, transported, or purchased.

2. The common carrier provisions of this section shall not apply to any natural gas pipeline operated by any person subject to regulation under the Natural Gas Act or by any public utility subject to regulation by a State or municipal regulatory agency having jurisdiction to regulate the rates and charges for the sale of natural gas to consumers within the State or municipality. Where natural gas not subject to State regulatory or conservation laws governing its purchase by pipeline companies is offered for sale, each pipeline company shall purchase, without discrimination, any such natural gas produced in the vicinity of the pipeline.

3. The authorized officer shall require, prior to issuing or renewing a right-of-way grant, that the applicant submit and disclose all plans, contracts, agreements, or other information or material which the authorized officer considers necessary to determine whether a right-of-way grant shall be issued or renewed and the terms and conditions which should be included in the grant. Such information may include, but is not limited to:

   a. Conditions for, and agreements among, owners or operators regarding the addition of pumping facilities, looping, or otherwise increasing the pipeline or terminal's throughput capacity in response to actual or anticipated increases in demand;

   b. Conditions for adding or abandoning intake, offtake, or storage points or facilities; and

   c. Minimum shipment or purchase tenders.

June 16, 1981
Date

James C. DeVore
Authorized Officer's Signature

Vice President/Engineering Operations
Title

A 17002

STIPULATIONS

LIMITATIONS ON EXPORT

Any domestically produced crude oil transported by pipeline over rights-of-way granted pursuant to this section, except such crude oil which is either exchanged in similar quantity for convenience or increased efficiency of transportation with persons or the government of an adjacent foreign state, or which is temporarily exported for convenience or increased efficiency of transportation across parts of an adjacent foreign state and reenters the United States, shall be subject to all of the limitations and licensing requirements of the Export Administration Act of 1969 (Act of December 30, 1969; 83 Stat. 841) (50 App., U.S.C. 2401 et seq.) and, in addition, before any crude oil subject to this section may be exported under the limitations and licensing requirements and penalty and enforcement provisions of the Export Administration Act of 1969 the President must make and publish an express finding that such exports will not diminish the total quantity or quality of petroleum available to the United States, and are in the national interest and are in accord with the provisions of the Export Administration Act of 1969; Provided, that the President shall submit reports to the Congress containing findings made under this section, and after the date of receipt of such report Congress shall have a period of sixty calendar days, thirty days of which Congress must have been in session, to consider whether exports under the terms of this section are in the national interest. If the Congress within this time period passes a concurrent resolution of disapproval stating disagreement with the President's finding concerning the national interest, further exports made pursuant to the aforementioned Presidential findings shall cease.

June 16, 1981
Date

James L. DeVoll
Authorized Officer's Signature

Vice President/Engineering Operations
Title

LAND REPORT
&
DECISION RECORD

State : Arizona
District : Phoenix
Resource Area: Kingman
Planning Unit: Cerbat Mountains

Type of Application or
Action: Gas Pipeline R/W
T&R : T's 21,22,23,24,25, & 26 N., R. 16 W.
Date(s) of Examination: 4/23/81 & 6/30/81

Serial No. A-17002
EA No. AZ-020-1-150

RECEIVED BY
DEC 16 1981
ENVIRONMENTAL EVALUATION BRANCH

Applicant's Name: Southwest Gas Corporation
Address : Box 15015, Las Vegas, Nevada 89114

A. Decision:

Southwest Gas Corporation will be granted a right-of-way for a buried gas pipeline at a width not to exceed fifty (50) feet, for a period of thirty (30) years.

The right-of-way will apply to the following public lands and shall be subject to special stipulations attached as Decision Record Attachment #1:

T. 24 N., R. 16 W., G&SRM

Section 10, W½W½W½;

Section 22, W½W½W½;

Section 34, W½W½SW¼.

T. 26 N., R. 16 W., G&SRM

Section 32, E½E½E½.

T. 25 N., R. 16 W., G&SRM

Section 8, E½E½E½;

Section 20, E½E½E½;

Section 28, NW¼, NE¼NE¼SW¼, SE¼;

Section 34, NW¼, NE¼SW¼, SE¼.

Aggregating 49.5 acres, more or less.

B. RATIONALE:

1. The Decision is the recommendation of the Land Use Analysis and was affirmed by the applicant, Southwest Gas Corporation, on September 21, 1981.

2. The public lands traversed by the right-of-way have been identified for disposal in the Cerbat Mountain Management Framework Plan. Granting of the right-of-way is consistent with the expansion of subdivision development in this area of the Hualapai Valley.

3. The right-of-way is the vital link in providing a stored natural gas supply that can be utilized to meet periods of high energy demand in the states of Nevada and Arizona.

C. MITIGATING MEASURES:

1. Brought Forward:

a. All above ground appurtenances associated with the pipeline right-of-way should be painted an earth tone color to blend with the surroundings.

b. The top 8 to 12 inches of surface soil should be salvaged and stockpiled. Upon closure of the trench, the stored soil should be redistributed along the line and compacted.

c. Watering or otherwise wetting disturbed areas should be required when windy conditions foster safety and health hazards during construction activities.

d. Excess subsurface soil remaining after trench construction and pipe installation are complete, should be removed and disposed of off site.

2. Dropped:

Important ornamental cactus species should be salvaged prior to construction.

The ornamentals within the proposed right-of-way were counted at the time of the June 30, 1981, field examination. Only a few species of buckhorn cholla and opuntia were encountered and were not of sufficient quantity to warrant commercial or public salvaging.

3. Added:

None

A-17002/2800 (KRA)
AZ-020-1-150

D. FINDING OF NO SIGNIFICANT IMPACT:

Residual impacts are of a minor and temporary nature. Environmental Assessment AZ-020-1-150 concluded that the proposed action will result in no significant environmental impacts. On the basis of the findings of the Environmental Assessment and Land Use Analysis sections of this report, it is determined that the proposed action will not have a significant effect on the human environment and therefore, does not require the preparation of a Environmental Statement.

E. SIGNATURES:

Preparer:

Michael L. Hanya — Realty Specialist — 9/22/81 Date

I Concur:

Roger D. Taylor — Area Manager — 9/22/81 Date

I Concur:

W. S. Barker — District Manager — 9/24/81 Date

SPECIAL STIPULATIONS

In addition to the terms and conditions specified in 43 CFR Subpart 2881 and Standard Stipulations developed by the BLM Arizona State Office, the Grantee, Southwest Gas, Incorporated, shall be bound to the following Special Stipulations:

1. The Grantee shall submit an Engineering/Survey proposal outlining the procedures to be used when removing and re-establishing survey monuments and U. S. Geological Survey benchmark and elevation markers along the course of the right-of-way. The proposal should be sent to Jim Kelley, Cadastral Survey, Arizona State Office, 2400 Valley Bank Center, Phoenix, Arizona 85073, as well as a copy to the Area Manager, Kingman Resource Area, 2475 Beverly Avenue, Kingman, Arizona 86401. The Grantee must obtain written approval from the Bureau of Land Management before a monument may be moved or buried.

2. Should additional rights-of-way be necessary across public land for temporary uses, such as construction easements, the Grantee shall obtain a Temporary Use Permit from the Area Manager, Kingman Resource Area, Kingman, Arizona, prior to entering said lands.

3. Prior to the Grantee's entry upon the public lands or to activities related to the removal of survey mouments, the Grantee must obtain a Notice to Proceed from the Area Manager, Kingman Resource Area, Kingman, Arizona. Said Notice shall be prepared when, in the judgement of the Area Manager, all terms and conditions of the right-of-way grant have been mutually accepted and environmental conditions are favorable with respect to the implementation of the proposed action.

4. The Grantee shall coat all paintable above ground appurtenances with a primer, suited to the desert environment, and shall paint same with one of the following options, unless another color meets the approval of the Kingman Resource Area Visual Resource Specialist:

   Option No. 1 - Mohave Sage #2304 (supplied by Southwest Paint).

   Option No. 2 - Olive #2323 (supplied by Southwest Paint).

   Option No. 3 - Ford Gray Industrial Enamel (supplied by Deer-O-Paints).

   Option No. 4 Cholla Green Industrial Enamel (supplied by Deer-O-Paints).

DECISION RECORD ATTACH #1

5. During the pipeline trenching construction activity, the Grantee shall insure that the top 8 to 12 inches of top soil is salvaged and is redistributed and compacted following the closure of the trench. Salvaging of the top 8 to 12 inches of soil will provide a natural source for vegetative rehabilitation.

6. The Grantee shall insure that excess subsurface soil removed during the trenching activity is removed off site. The disposal of such excess underburden shall be the responsibility of the Grantee.

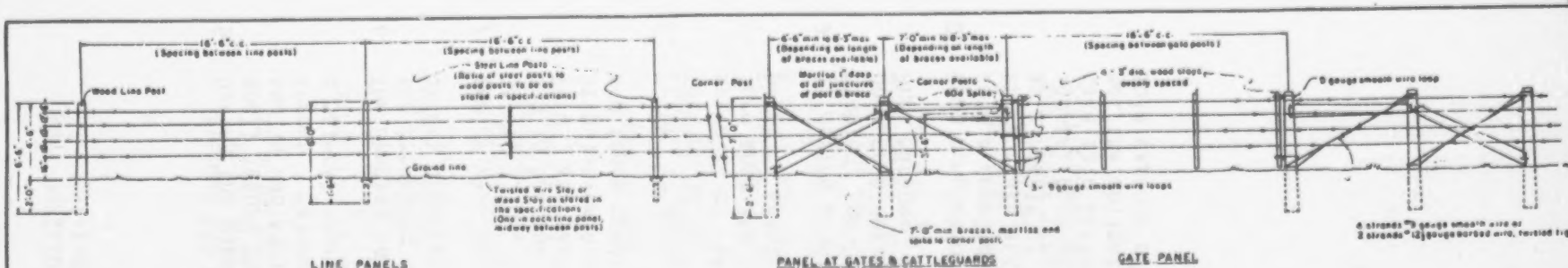
7. The Grantee shall insure that allotment fences removed from Section 34, T. 23 N., R. 16 W., G&SRM through Section 16, T. 24 N., R. 16 W., and in Section 10, T. 24 N., R. 16 W., and Section 22, T. 26 N., R. 16 W., are replaced to the same standard as that prior to construction. Stipulation Attachment #1, provides a recommended guideline should new fence construction be necessary.

8. Prior to disrupting the flow in the surface water pipeline in Section 34, T. 25 N., R. 16 W., G&SRM, the Grantee shall obtain the approval of rancher, John Neal, of Kingman , Arizona, and shall insure that the pipeline is restored to the same condition as that prior to construction.

9. If during construction activities dust becomes a health or safety problem, the Grantee shall insure that disturbed areas are watered down or otherwise controlled with a wetting agent approved by the Area Manager, Kingman Resource Area.

10. Upon completion of the project, the Kingman Resource Area will perform a compliance examination and may require the Grantee to take appropriate action or actions to repair damage to the environment as a result of the project. Should the Grantee, or their respective agents, contractors, subcontractors, or assigns, fail or refuse to take said actions, the United States shall have the right, but not the obligation, to perform any or all of such actions at the sole expense of the Grantee.

STIPULATION ATTACHMENT #1

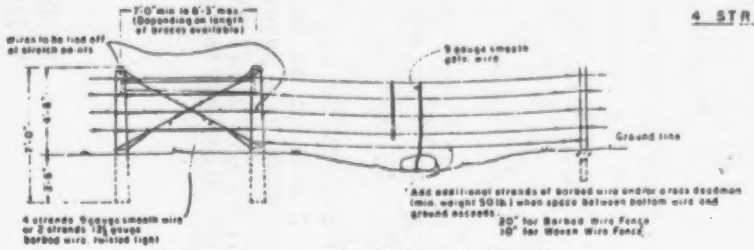

16'-6" c.c. (Spacing between line posts)
Wood Line Post
Steel Line Posts (Ratio of steel posts to wood posts to be as stated in specifications)
Ground line
Twisted Wire Stay or Wood Stay as stated in the specifications (One in each line panel, midway between posts)
Corner Post
6'-6" min to 8'-3" max (Depending on length of braces available)
Mortise 1" deep at all junctures of post & brace
7'-0" min to 8'-3" max (Depending on length of braces available)
Corner Posts
60d Spike
3'-0" min. braces, mortise and spike to corner post.
16'-6" c.c. (Spacing between gate posts)
6'-3" dia. wood stays evenly spaced
9 gauge smooth wire loop
3- 9 gauge smooth wire loops
4 strands 9 gauge smooth wire or 2 strands 12½ gauge barbed wire, twisted tight

LINE PANELS

PANEL AT GATES & CATTLEGUARDS

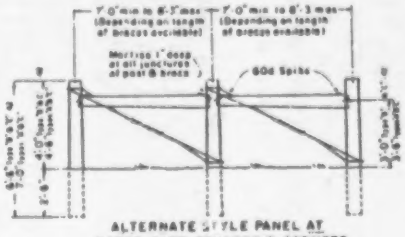
GATE PANEL

4 STRAND BARBED WIRE FENCE - TYPE "A"

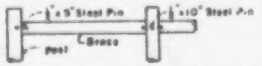

7'-0" min to 8'-3" max (Depending on length of braces available)
Wires to be tied off at alternate gate ends
9 gauge smooth galv. wire
Ground line
4 strands 9 gauge smooth wire or 2 strands 12½ gauge barbed wire, twisted tight
* Add additional strands of barbed wire and/or cross deadmen (min. weight 50 lb.) when space between bottom wire and ground exceeds
20" for Barbed Wire Fence
10" for Woven Wire Fence

STRESS PANEL

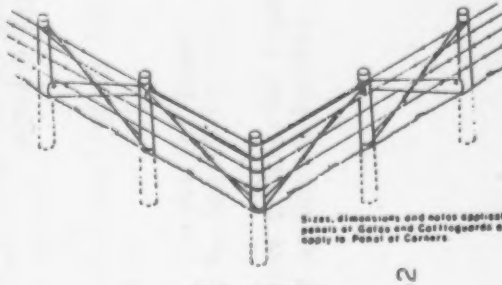
PANEL AT MINOR DEPRESSIONS


7'-0" min to 8'-3" max (Depending on length of braces available)
7'-0" min to 8'-3" max (Depending on length of braces available)
Mortise 1" deep at all junctures of post & brace
60d Spike

ALTERNATE STYLE PANEL AT GATES, CATTLEGUARDS & CORNERS



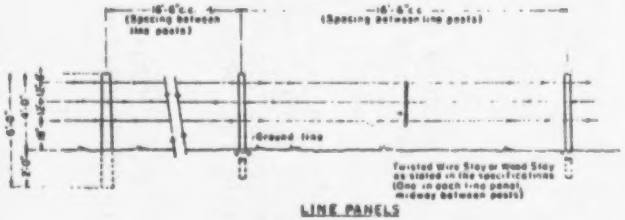
DOWELED CONNECTIONS
(Alternate for mortise-spike connections)



Sizes, dimensions and notes applicable to panels at Gates and Cattleguards also apply to Panel at Corners

PANEL AT CORNERS

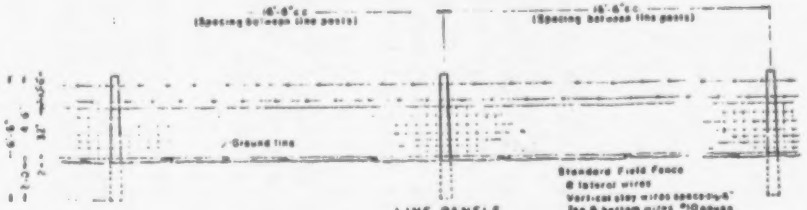
162


16'-6" c.c. (Spacing between line posts)
16'-6" c.c. (Spacing between line posts)
Ground line
Twisted Wire Stay or Wood Stay as stated in the specifications (One in each line panel, midway between posts)

LINE PANELS

2 STRAND BARBED WIRE FENCE - TYPE "B"

(All panel assemblies to be constructed identical to those for 4 strand fence except that all corner posts are 6' shorter.)


16'-6" c.c. (Spacing between line posts)
16'-6" c.c. (Spacing between line posts)
Ground line
Standard Field Fence
8 lateral wires
Vertical stay wires spaced 12"
Top & bottom wires #10 gauge
Intermediate & stay wires #12½ gauge

LINE PANELS

WOVEN WIRE FENCE - TYPE "C" - 48

(All panel assemblies to be constructed identical to those for 4 strand fence) TYPE "C" - 42 Same as above except 26" woven wire and 6' shorter posts.

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIV. ENGINEERING — WASHINGTON OFFICE

STANDARD
WIRE LIVESTOCK FENCES

SCALE 1" = 1'-0"

DATE 7 FEBRUARY 1964 — SHEET 1 OF 1

DRAWING NO. 08-33-9109.01-1

RECEIVED BY
DEC 16 1981
ENVIRONMENTAL EVALUATION BRANCH

A-17002/2800 (KRA)
AZ-020-1-150

NEPA COMPLIANCE

I. PURPOSE AND NEED FOR ACTION

On June 22, 1981, the applicant, Southwest Gas Corporation, submitted a right-of-way application to the BLM State Office for a 16 inch-in--diameter natural gas pipeline. The 50 feet in width buried pipeline will traverse approximately 8.199 miles of public land administered by the Bureau of Land Management. The proposed gas line will tie-in to an existing 34 inch-in-diameter high-pressure gas pipeline 7 miles southeast of the City of Kingman, Arizona, and proceed northerly a distance of approximately 30 miles to the applicant's proposed underground storage site, 2 miles east of the southern tip of Red Lake (dry) (Refer to Vicinity Map). Natural gas will be stored in underground caverns during periods of low gas use, when demand is low (summer) and will be piped to areas experiencing gas shortage problems when demand is high (winter).

Long-range gas supply forecasts prepared by El Paso Natural Gas indicate ever increasing gas shortage problems for southern Nevada and Arizona, given the continuation of existing supplies and an ever increasing demand for gas service. In an action to curtail such future gas shortages, the applicant, Southwest Gas Corporation, proposes to purchase and store surplus gas supplies within its service area where future public needs will require increased gas supplies. As a public service entity, the applicant bears the responsibility to plan for and take action to ensure continued gas service to its customers in Southern Nevada and Arizona.

II. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

A. Proposed Action

The applicant proposes to install a 16 inch-in-diameter gas pipeline to an average depth of between 36 to 48 inches below the surface (U. S. Department of Transportation). Construction and installation of the pipe will proceed in the following order: (1) clearing and grading of the right-of-way; (2) hauling and stringing the line pipe; (3) preparing the ditch; (4) bending the pipe; (5) laying and welding the pipe; (6) applying its protective coating or wrapping; (7) lowering it and tying it in; and (10) right-of-way cleanup, restoration and maintenance.

Roadways and railroads would be traversed by boring a horizontal hole through the feature at a minimum depth of 4 feet 5 inches below the rail base and 3 feet below the ditch elevation of a roadway. When crossing other structures, such as pipelines and cables, a minimum clearance of 24 inches would be required.

It is anticipated that pipeline construction will proceed at a rate of 2000 feet per day and would require approximately eighty (80) working days to complete. Heavy equipment needs may include seven bulldozers, seven backhoes, one ditching machine, one backfiller, two motor cranes, five flatbed trucks, and two dump trucks. Employment and personnel requirements for pipeline construction are estimated at near 280 workers.

The right-of-way will continue to be used for vehicular travel for the purpose of monitoring and maintaining the operation of the pipeline.

B. Alternative No. 1

No other alternative other than the "No Action Alternative" will be discussed in this assessment. Deviations in the alignment of the proposed pipeline route, presented as alternatives, would not lessen the environmental impacts associated with the proposed action.

III. AFFECTED ENVIRONMENT

A. Non-Living Components

1. Topography/Climate

The subject right-of-way area is located in the Hualapai Valley northeast of the City of Kingman in Mohave County, Arizona (Refer to Area Map). The proposed pipeline begins southeast of Interstate 40 at an elevation of approximately 3900 feet above sea level and ends southeast of Red Lake at an elevation of approximately 2800 feet above sea level. The topography is generally flat sloping downward to the north.

Average annual precipitation is highly variable but generally approaches the 8 to 10 inch range. The average July temperature is about 85°F while the average January temperature is near 45°F. The low humidity and high temperatures during the summer months result in a high evaporation rate causing a low exchange rate to the ground water and droughty vegetative conditions. Prevailing summer winds are usually southerly at from 7 to 10 knots while winter winds are northerly from 10 to 20 knots. Air quality problems due occur but are generally associated with airborne particulate matter and not high levels of pollutants, such as sulfur or nitrogen oxides.

2. Geology/Soils

The Hualapai Valley is underlain by sediments accumulated to several thousand feet and are a portion of the Muddy Creek Formation. These sediments were formed during the late Tertiary Period when volcanic rock composed of rhylite, latitic and esite and associated tuffs eroded along the southern reaches of the Cerbat Mountains. This erosion process from higher elevations to the valley floor is a present day occurrence.

The proposed pipeline route generally traverses the Anthony-Vinton-Agua Soil Association. This soil is identified as a sand, gravel and conglomerate. Depth to bedrock or hard-pan is usually greater than 60 inches. It is stratified, subject to flooding, and has a ph of from neutral to strongly alkaline (7.0 to 9.0). The permeability rate is from moderate to moderately rapid while erosion succeptibility is slight to high. Revegetation potential is considered as low to very low.

3. Cultural Resources

WESTEC Services, Inc., of California, was contracted by the applicant to conduct a cultural inventory of the proposed pipeline alignment. WESTEC obtained a permit from the Bureau of Land Management in early 1981 (DOI Antiquities Act Permit No. 020-AZ/80-258). The survey covered an area along the proposed pipeline route 250 feet in width. The survey method included 100 percent coverage and identified five (5) sites that may be impacted by the proposed action. WESTEC's results were incorporated in an assessment prepared by CER Associates of Las VEgas, Nevada.

Three of the five sites are located on public land administered by the Bureau of Land Management. Generally, the sites contained Indian artifiacts consisting of metate fragments, chert flakes, and hammerstones. The evidence found on the sites confirmed speculation as to the Indian useage of the area. It has been thought that the valley had been utilized only seasonally, the inhabitants occupying temporary campsites. This theory is proven valid as the sites located by WESTEC are indicative of temporary encampments where activities were limited to seed gathering and tool maintenance.

Southwest gas has employed WESTEC to inventory and prepare reports of all sites encountered during their survey. The reports are to be presented to the Bureau of Land Management for review and to determine if Section 106 compliance is necessary.

4. Aesthetics/Visual Resource Management

The southern portion of the pipeline right-of-way will traverse Interstate 40 and U. S. Highway 66. Due to the high rate of public travel along these thoroughfares, this area is within a highly noticeable view shed. The applicant proposes to parallel an existing buried pipeline through this particular area, thereby, avoiding a new intrusion. The northern portion of the pipeline, where public lands are encountered, lies within grazing allotments that are generally removed from a significant degree of public scrutiny.

B. Living Components

1. Vegetation

The Cerbat Mountain Planning Unit Resource Analysis identifies six vegetative subtypes that will be traversed by the proposed pipeline route. These subtypes include saltbush, half shrub, creosote bush, annuals, desert shrub, and grass (Brown and Lowe Classification). The slightest changes in soil moisture and substrate texture, depth, and mineral content can result in the intergrading of community types, a gradual replacement of one key species by another.

An environmental study conducted by CER Associates of Las Vegas, Nevada, in 1979 and 1980, provided results of vegetative transects located along the proposed pipeline route. This study indicates that the pipeline corridor would pass through five major plant communities. Four of the communities were discussed in the study and include the Mohave thorn community, shrub-grass disclimax community, desert grassland community, and saltbush community.

The Mohave thorn community includes such dominant species as Mohave thorn, California buckwheat, black gramma grass, and snakeweed. This community is located south of Interstate 40 on private lands at the higher elevations of the pipeline corridor.

Just north of Interstate 40 on private land, the shrub-grass disclimax community is encountered. The change in elevation and impacts associated with grazing have apparently resulted in this vegetative transition zone from the more dominant grass types to the north and the higher shrub types to the south. This community is dominated by snakeweed, black gramma grass, desert trumpet, fluff grass, and banana yucca.

The most common plant community occurring along the proposed gasline is the desert grassland community. This community is situated within a checkerboard land ownership pattern including state, private, and federal. The community is dominated by such perennials as big gelleta, black gramma grass, desert trumpet, and fluff grass. This community also exhibited evidence of grazing pressure as perennial plant cover within the community was relatively low.

The saltbush community is also located within a checkerboard land ownership area. This community is associated with the Red Lake playa soils in the viciinty of the pipeline terminus. The saltbush community is dominated by big galleta, four-winged saltbush, and Anderson thornbush.

2. Wildlife

During the same period (1979 & 1980), CER conducted wildlife surveys along the proposed pipeline route. Live trapping techniques for small mammals and reptile species and visual sightings of birds and large mammals produced a cross section of the specie diversity found throughout the Hualapai Valley.

Small mammals identified included pocket mice, Merriam's Kangaroo rat, black-tailed jackrabbit, and desert cottontail. Bureau of Land Management findings have concluded that ranges exhibiting an abundance of weedy vegetative species generally accelerate densities of pocket mice and Kangaroo rat populations. CER transects bear this fact out as it was concluded that the rodent populations along the proposed pipeline route are highly abundant.

Large mammal sightings and track analyses indicate the presence of such predators as coyotes, kit foxes, badgers, and skunks.

CER identified, by sighting, fifteen (15) species of birds along the pipeline aligment. This list includes six species of raptors of which the marsh hawk and long-eared owl are the most abundant. The remainder of the list is as follows: red-tailed hawk, golden eagle, American Kestrel, Gambel's quail, roadrunner, great horned owl, burrowing owl, poor-will, red-shafted flicker, ladder-backed woodpecker, horned lark, common raven, verdin, cactus wren, rockwren, mockingbird, LeConte's thrasher, sage thrasher, Mountain bluebird, loggerhead shrike, house finch and sage sparrow.

No evidence of desert tortoise habitation was observed along the gasline corridor. The Cerbat Mountain Planning Unit Resource Analysis indicates a wide variety of reptile species throughout the unit including 21 species of snakes and 17 lizard species. The most common among these include the following: zebra-tailed lizard, desert spiny lizard, long-tailed brush lizard, western garter snake, coachwhip snake, gopher snake, common kingsnake, western diamond-back rattlesnake, and Mohave rattlesnake.

3. Water Resources

The proposed gasline route will traverse only one major drainage, that being Truxton Wash. The wash only frequently contains water, generally from run-off occurring as the result of thunderstorm activities. The flow is south to north toward the Red Lake playa.

The Hualapai Valley contains an underground aquifer that has been only recently tapped to any significant degree within the last fifteen (15) years. Prior to 1964, well pumping accumulated to only 500 to 1000 acre/feet per year. In 1975, the rate approached 8000 acre/feet. While some water is utilized for livestock, the majority of the demand is for human consumption.

IV. ENVIRONMENTAL CONSEQUENCES

A. Proposed Action

1. Cultural Resources

WESTEC Services of California located five Indian relic sites along the proposed alignment of the gas line. Three of the five sites were found on public lands administered by the Bureau of Land Management. WESTEC has been contracted by the applicant, Southwest Gas Corporation, and has completed their work under an Antiquities Permit issued by BLM. Preliminary reports and correspondence with the BLM State Office Archeologist indicate that mitigation of these sites is not necessary prior to issuance of the right-of-way grant. A final report is expected from WESTEC and will be reviewed by the BLM State Office Archeologist. That report will be attached to the case file and is referenced to this report as "Exhibit A-1."

2. Wilderness

The pipeline route is not situated within an identified wilderness study area or a 5000 acre roadless area, not does it exhibit wilderness characteristics.

3. Area of Critical Environmental Concern (ACEC)

The pipeline route is not located within an identified Area of Critical Environmental Concern.

4. Visual Resource Management

The pipeline route traverses two senic zones identified under the criteria set forth in the Bureau of Land Management Planning Manual. Category D, situated north of the U.S. 66 and extending northward through the Hualapai Valley, exhibits a slight variety in topography and vegetation. In terms of visual quality, this area may be considered as moderate.

The second zone is identified as Category E and is located along U. S. 66 and subdivided areas lying north and south of the highway. This category exhibits low visual quality.

Above ground appurtenances along the pipeline displaying bright, shiny colors may impair the existing view shed north of U. S. 66 in Category D. The area VRM specialist recommends all above ground facilities on the pipeline route be painted a color that will blend in with the surrounding earth tones.

5. Floodplain

The pipeline route traverses the Truxton Wash approximately five (5) miles south of Red Lake. The wash contains water only periodically, although there have been historical accounts of flooding activity along the course of the wash. The pipeline will be buried at a depth that will insure the integrity of the line during high water periods. The remainder of the buried line will be located southerly at increasing elevations. The facility is not situated within an identified floodplain.

6. Vegetation - (Threatened and Endangered)

A study completed by WESTEC Services of Las Vegas, Nevada, positively identified the spiney prickley pear cactus (Opuntia phaecantha ssp. superbospina) that was, at that time, classified as a sensitive species by the State of Arizona. This particular species is no longer considered in the sensitive category by the Bureau of Land Management. No endangered, threatened or sensitive species are known to exist within the proposed pipeline corridor (See Exhibit A-2).

7. Wildlife - (Threatened and Endangered)

A WESTEC Servies study concluded that no federally listed threatened or endangered species were identified along the pipeline route.

8. Air Quality

The pipeline will traverse an area that experiences moderate to severe wind erosion resulting in a significant amount of air borne particulates during windy periods. During the construction phase of the proposed action, increased particulate loading of the atmosphere will occur during such windy periods.

B. Alternative #1 (No Action)

There are no environmental consequences associated with the "no action" alternative where the proposed action, to grant the right-of-way, would be rejected in its entirety.

V. MITIGATING MEASURES

A. Proposed Action

1. All above ground appurtenances associated with the pipeline right-of-way should be painted an earth tone color to blend with the surroundings.

2. The top 8 to 12 inches of surface soil should be salvaged and stockpiled. Upon closure of the trench, the stored soil should be redistributed along the line and compacted.

3. Important ornamental cactus species should be salvaged prior to initiation of construction activities (Per Exhibit A-2).

4. Watering or otherwise wetting disturbed areas should be required when windy conditions foster safety and health hazards during construction activities.

5. Excess subsurface soil remaining after trench construction and pipe installation are complete, should be removed and disposed of off site.

B. Alternative #1 (No Action)

No mitigating measures are considered under the "no action" alternative.

VI. RESIDUAL IMPACTS/COMMITMENT OF IRREVERSIBLE OR IRRETRIEVABLE RESOURCES

The proposed action will result in a temporary disturbance to wildlife habitat, soil stability, and air quality. A small number of cactus species and grasses will be removed. During construction and following completion of the action, wind and water erosion will be accelerated

but will decrease over time as soil and vegetation conditions stabilize. The expenditure of fossil fuels necessary to implement the action and to monitor the facility will be foregone.

VII. CONSULTATION AND COORDINATION

William E. Adams - Project Manager, Southwest Gas Corporation.

James Sanders - Right-of-Way Agent - Southwest Gas Corporation.

Alan J. Schilz - WESTEC Services.

Lon Lister - EIS Team Leader, Federal Energy Regulatory Commission.

Leo VanDerHarst - CER Consultants.

Public comment was not solicited during the preparation of this environmental assessment. The Kingman Daily Miner of Kingman, Arizona, related the Federal Energy Regulatory Commission's connection with the overall gas storage project in an article published on June 18, 1981. On July 19, 1981, the paper ran a news release submitted by the Southwest Gas Corporation relating the company's project time frame and the employment benefits to be derived from the gas storage activity.

A request for public comments was solicited in Volume 46, No. 157, Page 41217, of the Federal Register on Friday, August 14, 1981 (Exhibit B). In response to that Notice, BLM received comments from the Arizona Game & Fish Department and the Arizona Natural Heritage Program (Attached as Public Comments 1 and 2).

The Arizona Game & Fish Department requested that all gates on the right-of-way access road remain unlocked. Southwest Gas Corporation intends to utilize the pipeline right-of-way for access purposes to perform monitoring and maintenance activities. While there are no plans to lock gates that will be constructed where allotment boundary fences traverse the pipeline route, continuous federal and/or state ownership is not available. To insure continuous public access along the course of the pipeline, easements would be required for numerous private landowners. Stipulation to require Southwest Gas Corporation to insure ready public access can not be justified.

A second Game and Fish comment requested that the pipeline design at wash crossings be adequate to withstand peak flood stages. U. S. Department of Transportation regulations normally require a 36 to 48 inch cover depending on the pipeline location. Considering that the pipeline will be constructed in a gradual sloping area, the danger of massive subsurface soil movement is remote. A buried depth of from 3 to 4 feet from the top of the pipe when crossing washes is deemed adequate to insure the integrity of the gas line.

The Arizona Natural Heritage Program requested a map depicting the route of the gas line and expressed concern that rare plants and/or animals may be impacted by the proposed action. On the basis of an independent

survey conducted by WESTEC Services of Las Vegas, Nevada, and field examinations by BLM resource specialists, no threatened or endangered plant or animal species were identified within the proposed pipeline right-of-way.

BRUCE BABBITT, Governor

Commissioners:
WILLIAM H. BEERS, Prescott, Chairman
CHARLES F. ROBERTS, O.D., Bisbee
FRANK FERGUSON, JR., Yuma
FRANCES W. WERNER, Tucson
CURTIS A. JENNINGS, Scottsdale

Director
BUD BRISTOW

Deputy Director
ROGER J. GRUENEWALD

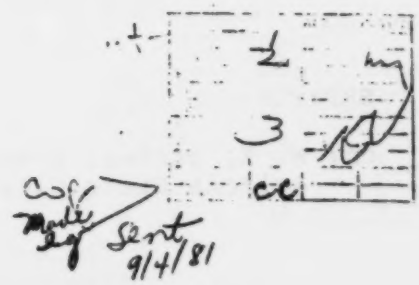
ARIZONA GAME & FISH DEPARTMENT

2222 West Greenway Road Phoenix, Arizona 85023 942-3000
1420 West Beale Street, Kingman, AZ 86401

August 31, 1981

BLM
PHOENIX DISTRICT

'81



Mr. Clair Whitlock, State Director
Arizona State Office
Bureau of Land Management
2400 Valley Bank Center
Phoenix, Arizona 85073

Dear Mr. Whitlock:

In response to the Notice of Application, serial number A-17002, whereby the Southwest Gas Corporation applies for a right-of-way to construct a 16 inch O.D. pipeline from the El Paso Natural Gas Company's pipeline system south of Kingman, Arizona to the Red Lake area, Hualapai Valley, the following comments are provided.

The 54 acres of public lands expected to be impacted by this proposal offer little value to wildlife because of the lack of diversity, type, and condition of the habitat. Therefore the Department has no objection to the construction of these facilities provided:

- all gates on the right-of-way access road remain unlocked; and

- the pipeline design at wash crossings is adequate to withstand peak flood stages.

The Department has expressed significant concern with other aspects of the Southwest Gas Corporation's proposal to construct and operate a subterranean gas storage facility at Red Lake. Therefore, we would appreciate notification of plans to implement each aspect of the complete proposal as they are made available to your office.

RECEIVED
SEP 10 19..

173

AN EQUAL OPPORTUNITY AGENCY

KINGMAN RE PUBLIC COMMENT #1

Thank you for the opportunity to comment on this application.

Sincerely,

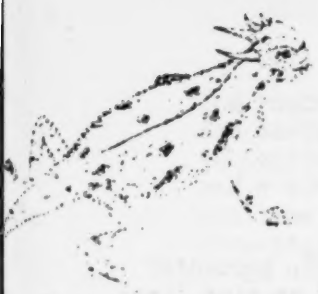
Bud Bristow, Director

Steve K. Ferrell
Habitat Evaluation Specialist
Kingman Regional Office

SKF:rlh

cc: W. K. Barker, Phoenix District Office, BLM
Arizona State Clearinghouse, AZ 81-60-0081

Arizona Natural Heritage Program



Phrynosoma mcallii

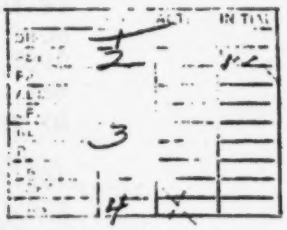
THE STATE OF ARIZONA
in cooperation with
THE NATURE CONSERVANCY

30 NORTH TUCSON BLVD.
TUCSON, ARIZONA 85716
(602) [illegible]857

2 September 1981

PHOENIX DISTRICT

'81



William L. Barker, District Manager
BLM--Phoenix District
2929 West Clarendon
Phoenix, AZ 85017

Dear Mr. Barker:

We would appreciate some information on Notice of Application (Serial No. A-17002) filed by Southwest Gas Corporation for a natural gas line from Kingman to Red Lake. A map showing the route would be very useful. Would the route be within an existing utility corridor?

We are primarily concerned with any impact this project may have on any rare plants, animals or plant communities. Our information indicates there are few rare elements in this area so the likelihood of something along the corridor is slim.

Sincerely,

Douglas Koppinger

Douglas Koppinger

PUBLIC COMMENT #2

Honorary Chairman GOVERNOR BRUCE BABBITT
Coordinator TERRY B. JOHNSON

LAND USE ANALYSIS

I. DECISION FACTORS

A. Proposed Action And Land Use

The proposed Action, as discussed in EA #AZ-020-1-150, presented a right-of-way alignment that would generally follow section lines as a center line. Environmentally, an alternative alignment would not be beneficial in terms of minimizing impacts to living organisms. A significant impact would occur to the monumentation of G.L.O. survey markers. In that regard, BLM requested the applicant to re-assess the right-of-way alignment, off-setting same to avoid removing a significant number of survey corners. On September 21, 1981, the Engineering and Right-of-way departments of Southwest Gas concurred that the pipeline route was intended to be off-set by design.

The right-of-way application and description are therefore inaccurate and are recommended for revision in the recommendation section to follow. The revised route, off-setting 50 feet on one side of the section line, will not adversely impact or impede existing land uses. The Cerbat Mountain Management Framework Plan identifies those public lands traversed by the pipeline as available for disposal via exchange. The Decision to grant the right-of-way is consistent with the current Bureau policy to provide for public needs and to promote community development.

B. Land Status

The total pipeline route will cover a linear distance of nearly 30 miles (Refer to General Location Map). The Land Status Map depicts the proposed route according to land ownership. As described in Section A above, the pipeline will gnereally be off-set of the north-south section lines a distance of 50 feet. The alignment, as shown on the Project Maps, will traverse approximately 8.2 miles of public land administered by the Bureau of Land Management, 4.2 miles of State owned land, and 17.6 miles of private owned property. The project will bear easterly of the north-south section lines from Section 13, T. 21 N., R. 16 W., through Section 4, T. 24 N., R. 16 W. From that point northward and after diagonally traversing Sections 34 and 28, T. 25 N., R. 16 W., the project will bear westerly of the north-south section lines.

Of primary importance, is the fact that due to the close proximity of the project route to section corners and quarter corners blading and trenching activities may result in the damage to or displacement of monuments (See Photo Presentations).

The route will traverse Interstate Highway 40, an Atchinson Topeka and Santa Fe railroad line, Highway 66, allotment boundary fences in Section 10, T. 24 N., R. 16 W., and Section 22, T. 26 N., R. 16 W., and a surface water pipeline in Section 34, T. 25 N., R. 16 W. The gas line construction will also result in the removal and re-construction of the allotment boundary fence beginning in Section 34, T. 23 N., R. 16 W., and ending in Section 16, T. 24 N., R. 16 W., or a distance of 9 miles. Photos #11 and #21 depict U. S. Geological Survey markers (one benchmark and one elevation) that may be disturbed during pipeline construction.

Stipulations will be developed to insure proper re-establishment of all monuments and markers.

C. Location, Identification and Access

The proposed gas pipeline will be installed within a geographic area known as the Hualapai Valley, just northeast of Kingman, Arizona. The subject lands were identified using USGS topographic maps and monuments located on the ground during field examinations.

The pipeline route is generally cross country and is not accessible via existing road systems throughout its entire course. The applicant will have to acquire right-of-way from private landowners and the State of Arizona prior to securing legal access along the length of the pipeline route.

D. Ownership And Land Use On Adjoining Lands

The Land Status Map depicts the "checkerboard" land ownership pattern characteristic of the project area. The pipeline route traverses four grazing allotments, the Long Mountain Allotment, the Canyon Allotment, the Cedar Canyon Allotment and the Cane Springs Allotment. The intermingled private, State, and Federal land are licensed, on a precent basis, for livestock grazing. No other land use are evident.

E. Projected Land Use And The Proposed Action

Bureau land use plans identify the public lands in this area for disposal. Given the relatively close proximity to the Kingman residential area, the project route and surrounding properties exhibit potential for subdivision and commercial development. The proposed action, to introduce natural gas and perhaps other utilities into an otherwise undeveloped area, will be beneficial in terms of future land development.

I. RECOMMENDATION/RATIONALE

It is recommended that the right-of-way be granted as described in Part A of the Decision Factors Section of this report.

A-17002/2800 (KRA)
AZ-020-1-150

Right-of-way grant A-17002 should be issued pursuant to Subpart 2880, Title 43 of the Code of Federal Regulations, for a width of 50 feet, for a period of 30 years, and shall include the following public lands:

T. 24 N., R. 16 W., G&SRM

Section 10, W½W½W½;

Section 22, W½W½W½;

Section 34, W½W½SW¼

T. 25 N., R. 16 W., G&SRM

Section 8, E½E½E½;

Section 20, E½E½E½;

Section 28, NW¼, NE¼NE¼SW¼, SE¼;

Section 34, NW¼, NE¼SW¼, SE¼.

T. 26 N., R. 16 W., G&SRM

Section 32, E½E½E½.

Aggregating 49.5 acres, more or less.

Rationale:

EA #AZ-020-1-150 provides support documentation that no significant environmental impacts will occur as the result of the proposed action. This Land Use Analysis concludes that the recommended alternative is not inconsistent with land use plans or community needs. The 50 feet width and 30 year term are consistent with Subpart 2880, 43 CFR.

APPENDIX B
SEISMIC SURVEY

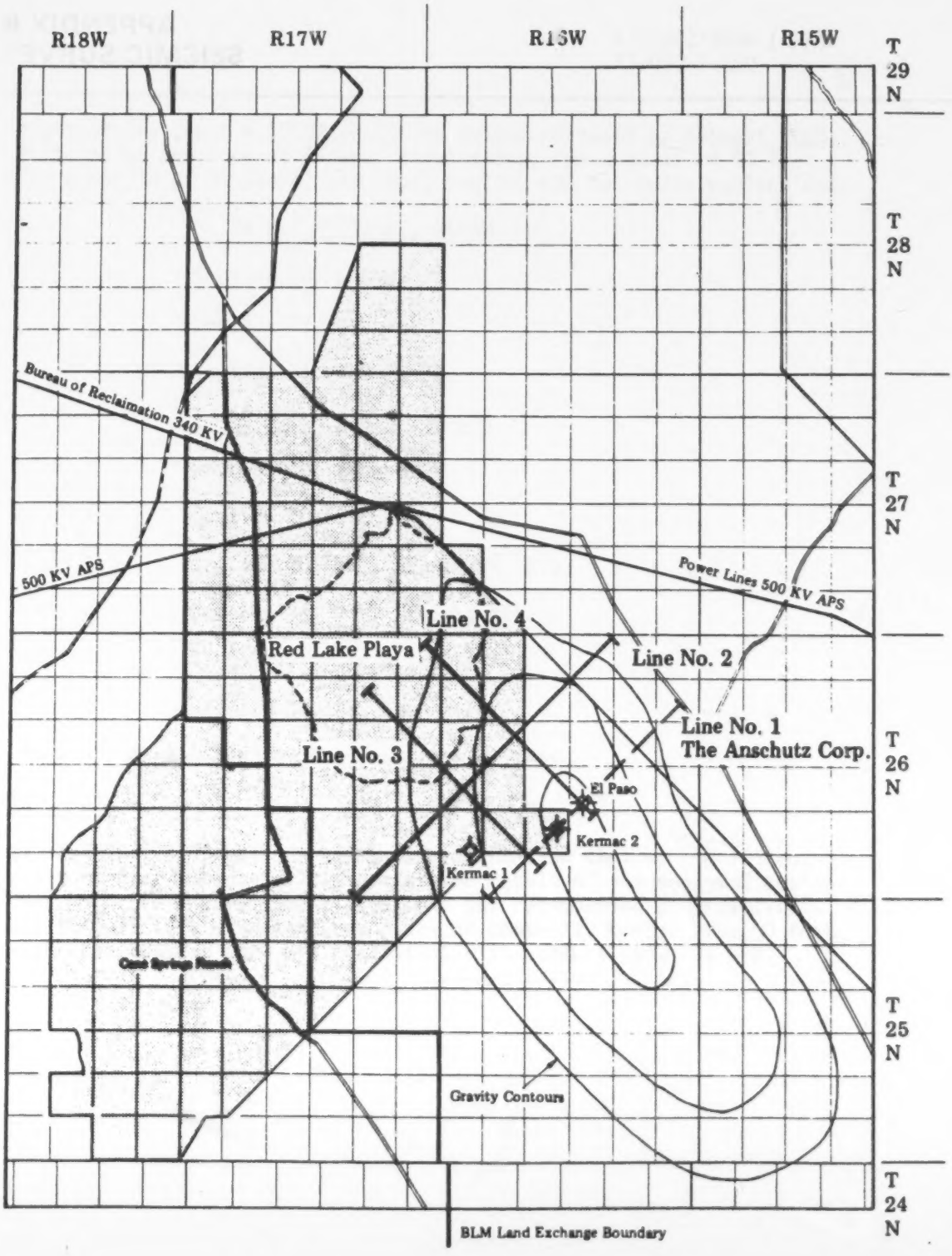


Figure B-1
Seismic Survey Lines

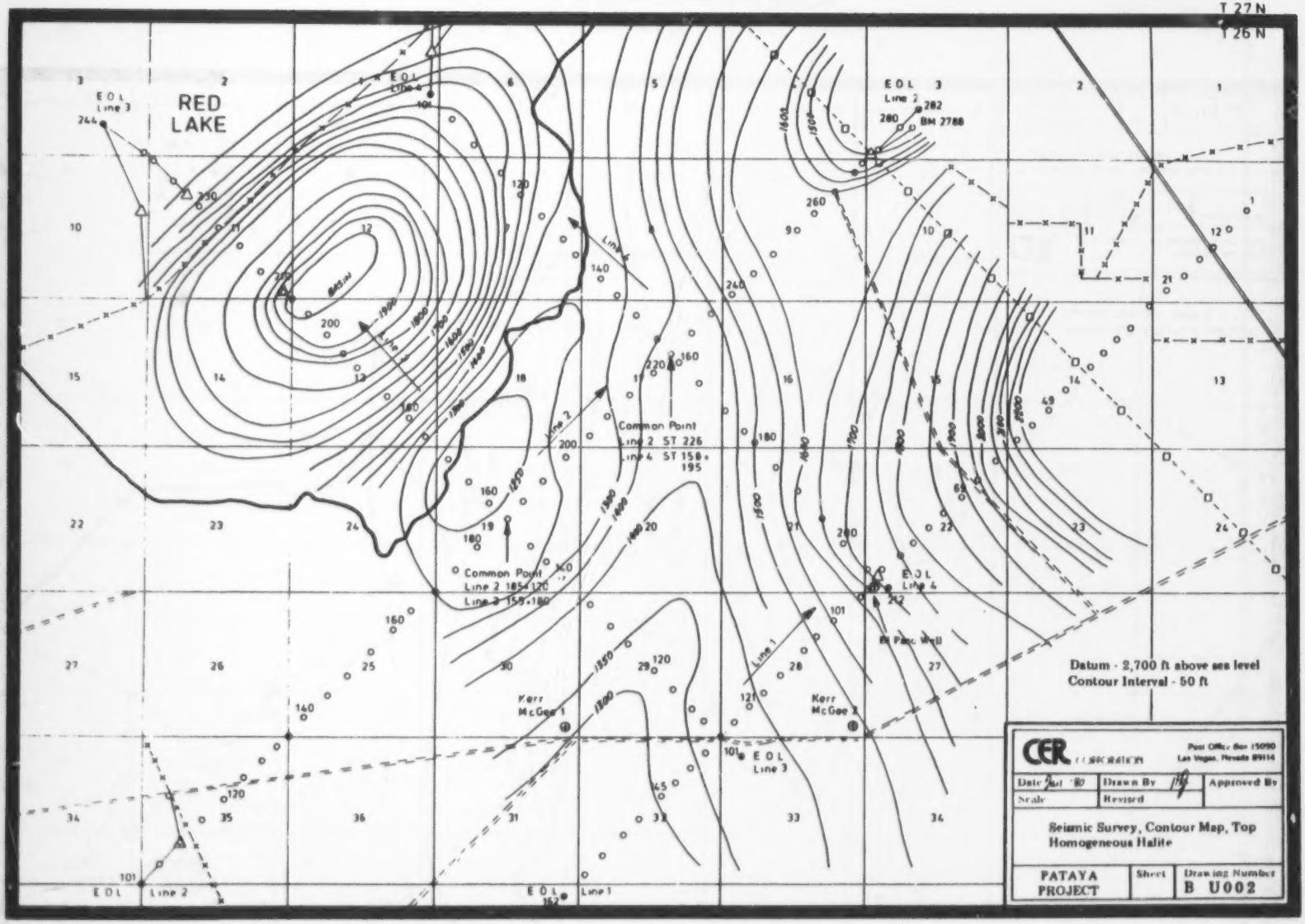


Figure B-2
Contour of Homogeneous Halite

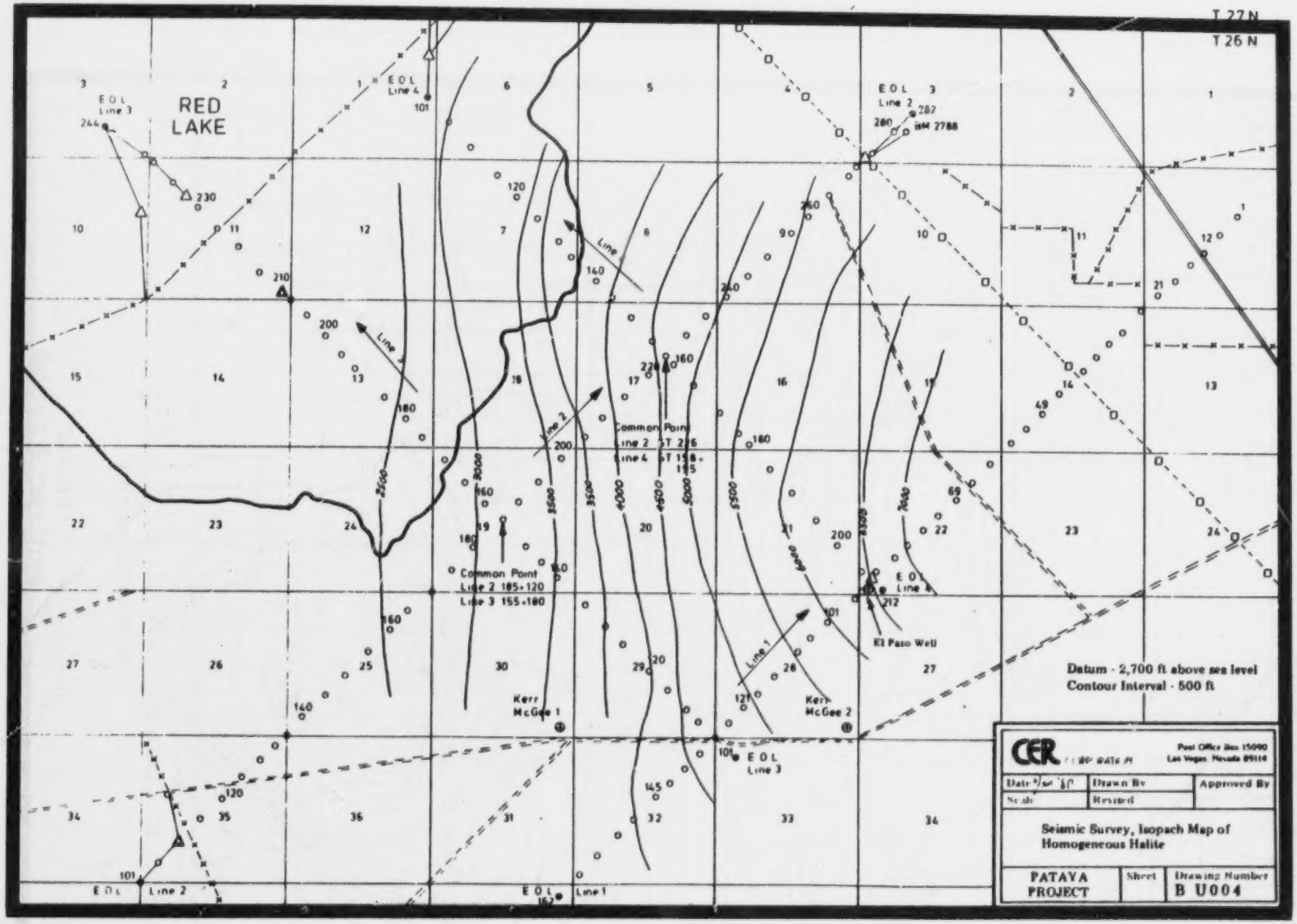


Figure B-3

Thickness of Homogeneous Halite

APPENDIX C
PHOTOGRAPHS FROM FEBRUARY 1982 FIELD INVESTIGATION

Figure C-1
Typical Old Cracks South of Playa

Figure C-2
Typical Old Cracks on Playa

Source: CER Corporation

Figure C-3

Typical Exploratory Trench

Source: CER Corporation

Figure C-4

Slumped Block-Type Filling of Fissures

Figure C-5
Recent Crack Showing Gullying Within Fissure

Figure C-6
Recent Crack Showing Gullying Adjacent to Fissure

Source: CER Corporation

Figure C-7

Recent Fissure Showing Ponded Rainwater

Source: CER Corporation

Figure C-8

Recent Fissure Showing Soil Washing In From Sides

Source: CER Corporation

Figure C-9

Slumped Block-Type Filling of Recent Fissures

Source: CER Corporation

Figure C-10

Deep, Open Surface Expression of Recent Fissure

APPENDIX D
CONSULTATION ON ENDANGERED SPECIES

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON 20426

IN REPLY REFER TO:
OPPR/DPC-EEB
Docket No. CP80-581
Pataya Storage
Company

Area Manager
Fish and Wildlife Service
U.S. Department of the Interior
2953 West Indian School Road
Phoenix, Arizona 85017

APR 6 1981

Attention: Endangered Species Specialist

Dear Sir:

The Environmental Evaluation Branch (EEB) of the Federal Energy Regulatory Commission is currently analyzing the environmental impact associated with an application by Pataya Storage Company (Pataya) to construct and operate an underground natural gas storage facility near Red Lake in Mohave County, Arizona. Pataya specifically proposes to construct two underground storage caverns, 1.3 square miles of diked evaporation ponds, a natural gas compressor station, approximately 30 miles of 16-inch diameter natural gas pipeline, approximately 30 miles of electric powerline, and about 6 miles of improved access road. Enclosed is a map showing the location of the proposed facilities.

The EEB has determined that the proposed project is a major Federal action significantly affecting the quality of the human environment and is preparing a draft environmental impact statement on it. In accordance with the Endangered Species Act as amended, please indicate whether any federally listed or proposed threatened or endangered species may be present in the area of the proposed project.

Thank you for your assistance. If you require additional information, contact Mr. John Estep of the EEB by telephoning (202) 357-8883 or FTS 357-8883.

Sincerely,

Richard R. Hoffmann

Richard R. Hoffmann, Acting Chief
Environmental Evaluation Branch

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
AREA OFFICE, ARIZONA - NEW MEXICO
2953 W. INDIAN SCHOOL ROAD
PHOENIX, ARIZONA 85017

April 23, 1981

RECEIVED BY
APR 29 1981
ENVIRONMENTAL EVALUATION BRANCH

Richard R. Hoffmann, Acting Chief
Environmental Evaluation Branch
Federal Energy Regulatory Commission
Washington, D.C. 20426

Re: OPPR/DPC-EEB
Docket No. CP80-581
Pataya Storage Company

Dear Mr. Hoffmann:

This is in reply to your letter of April 6, 1981, which requested information about species which are listed or proposed to be listed as threatened or endangered as provided by the Endangered Species Act. Your area of interest is the construction and operation of an underground natural gas storage facility near Red Lake, Mohave County, Arizona.

The Fish and Wildlife Service provides upon request a list of those species, both proposed and listed, which may be affected by Federal construction activities.

Our data indicates no listed or proposed species would be affected by the proposed action in the area of interest. If I may be of further assistance, do not hesitate to call (602-241-2487; FTS 261-2487).

Sincerely yours,

Area Manager

cc:
Regional Director, U.S. Fish and Wildife Service (SE), Albuquerque, NM
Field Supervisor, U.S. Fish and Wildlife Service, Phoenix, AZ

APPENDIX E
NATIONAL HISTORIC PRESERVATION ACT CONSULTATION

DEC 21 1981

FEDERAL ENERGY REGULATORY COMMISSION

WASHINGTON 20426

RECEIVED BY

JAN 0 1982

ENVIRONMENTAL EVALUATION BRANCH

IN REPLY REFER TO:
OPPR/N6200
Docket No. CP80-581
Pataya Storage Company

Louis S. Wall, Chief
Western Division of Project Review
Advisory Council on Historic Preservation
Lake Plaza South, Suite 166
44 Union Boulevard
Lakewood, California 80228

DEC 9 1981

Dear Mr. Wall:

Pataya Storage Company, a wholly owned subsidiary of Southwest Gas Corporation (Southwest) proposes to construct an underground natural gas storage facility consisting of two solution-mined salt caverns, brine evaporation ponds, 30 miles of 16-inch diameter pipeline, a 5,400-horsepower compressor station, and three 465-horsepower electric power generators, affecting approximately 2,220 acres. The proposed plant would be located approximately 30 miles north of Kingman, Arizona, on the relatively flat surface of Hualapai Valley, an intermontane alluvial basin bounded by the Cerbat Mountains to the west and the Grand Wash Cliffs of the Colorado Plateau to the east.

WESTEC Services, Inc. of Santa Ana, California, under contract to Southwest, has identified 22 archaeological sites in the project area deemed eligible for the National Register of Historic Places. These are listed in WESTEC's report, *Cultural Resource Inventory and Test Excavation Results* (Vol. II), dated October 1981. The relevant sections of this report are enclosed. A request for a formal determination of eligibility by the Keeper of the National Register has been submitted simultaneously, in accordance with 36 CFR 800.4(a)(4).

WESTEC has concluded that the proposed project would have no adverse effect on those characteristics of the sites which make them eligible for the National Register. It believes the significance of these sites lies in the fact that they "have yielded, or may be likely to yield, information important in prehistory or history"--criterion (d), 36 CFR 1202.6--and that impact to them can be readily mitigated through a data recovery program. The program which WESTEC proposes to employ is explained in the enclosure.

The staff of the Federal Energy Regulatory Commission (FERC) concurs with WESTEC's determination that the 22 listed sites are eligible for the National Register for the criterion stated. The staff further concurs with the no adverse effect determination pursuant to 36 CFR 800.4(c) and with the mitigation program upon which this determination is based. The Arizona State Historic Preservation Officer has orally informed the Commission staff of her concurrence with both of these determinations; her written concurrence is anticipated in the near future. When these comments are available, a copy of them will be sent directly to you from Phoenix.

The Advisory Council's "Supplementary Guidance for Review of Proposals for Treatment of Archaeological Properties" has been reviewed; the criteria in section X have been applied. Questions A1, A2, and B3 can be answered in the affirmative. Adverse effects will be negated by completion of the data recovery plan.

The Commission staff requests that the Advisory Council make a determination of effect for the 22 eligible sites affected by the proposed project pursuant to 36 CFR 800.6(a). Your prompt attention to this matter is requested because of project deadlines.

Any questions concerning this matter may be addressed to Mr. J. T. Griffin of the Commission's Environmental Evaluation Branch (202-357-9047).

Very truly yours,

Eugene Tomlinson

Kenneth A. Williams, Director
Office of Pipeline and Producer Regulation

Enclosure

cc: Patricia Giorgi, Archaeologist
Bureau of Land Management
Arizona State Office
2400 Valley Bank Center
Phoenix, Arizona 85073

Allan Schilz, Project Architect
WESTEC Services, Inc.
118 Brookhollow Drive
Santa Ana, California 92705

CONCUR
DEC 24 1981
ADVISORY COUNCIL ON HISTORIC PRESERVATION
BY

FILED
DEC 31 AM 11:59

December 28, 1981

RECEIVED BY
JAN
ENVIRONMENTAL EVALUATION BRANCH

Kenneth F. Plumb
Federal Energy Regulatory Commission
825 North Capitol Street, N.E.
Washington, D.C. 20426

OFFICIAL COPY

TO	INIT.	DATE
DOCKET		

CENTRAL FILES

Re: Southwest Gas Corporation
Red Lake Salt Cavern Gas
Storage Facility
FERC Docket No. CP80-581
FERC/DOI-BLM

ARIZONA STATE PARKS

1688 WEST ADAMS STREET
PHOENIX, ARIZONA 85007
TELEPHONE 602-255-4174

BRUCE BABBITT
GOVERNOR

STATE PARKS
BOARD MEMBERS

SAM RAMIREZ
CHAIRMAN
PHOENIX

A. C. WILLIAMS
VICE CHAIRMAN
PRESCOTT

DUANE MILLER
SECRETARY
SEDONA

PRISCILLA ROBINSON
TUCSON

CABOT SEDGWICK
NOGALES

GWEN ROBINSON
YUMA

JOE T. FALLINI
STATE LAND COMMISSIONER

MICHAEL A. RAMNES
DIRECTOR

ROLAND H. SHARER
DEPUTY DIRECTOR

Dear Mr. Plumb:

I have now completed review of all the documentation submitted for this proposed undertaking and have the following comments:

1. I am satisfied that the archaeological surveys and test excavations carried out by Westec Services for Southwest Gas Corporation have adequately fulfilled the requirements of 36 CFR 800.4(a)(1)&(2) for identifying National Register and eligible properties that might be affected by this undertaking.

2. Westec Services' report, Cultural Resource Inventory and Test Excavation Results, Vol. II, documents that twenty-two (22) archaeological sites located in the project area have the potential to yield significant information important to a fuller understanding of the prehistoric/historic aboriginal utilization of this area in Arizona.

3. Therefore, pursuant to 36 CFR 63.3, I concur with FERC, as the lead Federal agency, that these twenty-two archaeological sites are eligible for inclusion in the National Register of Historic Places by satisfying criterion "d" of the Criteria for Evaluation (36 CFR 60.6).

4. Staff of FERC and the BLM have consulted with this office regarding the potential impacts to these twenty-two archaeological sites and we are in concurrence that the potential adverse effects of the project can be negated through implementing a well developed data recovery program. In considering the ACHP's Supplementary Guidance for Treatment of Archaeological Properties, we applied the criteria in Section X for making a determination of "no adverse effect" and concluded that questions A(1), A(2) and B(3) could be answered in the affirmative. By im-

FILED
1981 DEC 31 AM 11:59
FERC
REGULATORY COORDINATION

plementing the proposed data recovery program, which appears consistent with the Advisory Council's "Recommendations for Archaeological Data Recovery", any potential impacts to the twenty-two archaeological sites will be negated by preserving the significant information that they contain.

5. Accordingly, pursuant to Section 800.4(c) of the Advisory Council's regulations ("Protection of Historic and Cultural Properties" - 36 CFR Part 800), I am in concurrence with FERC's determination of No Adverse Effect for this proposed undertaking.

The cooperation of FERC with this office is appreciated. If you have any questions about any of this, please contact me at 255-4174.

Sincerely,

Frank B. Fryman
Archaeologist/Compliance Coordinator

for Ann A. Pritzlaff
State Historic Preservation Officer

FBF:mes

cc: Carol Shull
Acting Keeper of the National Register

Louis S. Wall
ACHP, Lakewood

Patricia Giorgi
BLM, Phoenix

United States Department of the Interior

NATIONAL PARK SERVICE
WASHINGTON, D.C. 20240

RECEIVED BY
JAN 20 1982
ENVIRONMENTAL EVALUATION BRANCH

IN REPLY REFER TO: 710

JAN 12 1982

Mr. Kenneth A. Williams, Director
Office of Pipeline and Producer
Regulation
Federal Energy Regulatory Commission
Department of Energy
825 N. Capitol Street N.E.
Washington, D.C. 20426

Dear Mr. Williams:

Thank you for your letter requesting a determination of eligibility for inclusion in the National Register pursuant to Executive Order 11593 or the National Historic Preservation Act of 1966, as amended. Our determination appears on the enclosed material.

As you understand, your request for our professional judgment constitutes a part of the Federal planning process. We urge that this information be integrated into the National Environmental Policy Act analysis in order to bring about the best possible program decisions. This determination does not serve in any manner as a veto to uses of property, with or without Federal participation or assistance. Any decision on the property in question and the responsibility for program planning concerning such properties lie with the agency or block grant recipient after the Advisory Council on Historic Preservation has had an opportunity to comment.

We are pleased to be of assistance in the consideration of historic resources in the planning process.

Sincerely yours,

Carol D. Shull

Carol D. Shull
Acting Keeper of the
National Register

Enclosure

OFFICE OF THE DIRECTOR
OPPR
JAN 19 3 07 PM
RECEIVED

E.O. 11593

DETERMINATION OF ELIGIBILITY NOTIFICATION
National Register of Historic Places
National Park Service

Project Name: Red Lake Salt Cavern Gas Storage Project

Location: Mojave County **State:** AZ

Request submitted by: FERC Kenneth A. Williams

Date Received: 12/14/81 **Additional information received:** 12-29-81;1-4-82

Name of property	Eligibility SHPO opinion	Eligibility Secretary of the Interior's opinion	Criteria
AZ:F:8:15	eligible	eligible	D
AZ:F:8:18	"	"	"
AZ:F:8·20	"	"	"
AZ·F:8:24	"	"	"
AZ:F:8:25	"	"	"
AZ:F:8:26	"	"	"
AZ:F:8·31	"	"	"
AZ:G·5:4	"	"	"
AZ G:5:5	"	"	"
AZ:F:8:34	"	"	"
AZ:F:8:37	"	"	"
AZ:F:8:38	"	"	"
AZ:F:8:39	"	"	"
AZ:F 8:40	"	"	"
AZ:F:8:43	"	"	"
AZ:F:8:44	"	"	"

g'n Keeper of the National Register

Date: 1/12/82

WASO-27

E.O. 11593

DETERMINATION OF ELIGIBILITY NOTIFICATION
National Register of Historic Places
National Park Service

Project Name: Red Lake Salt Cavern Gas Storage Project

Location: Mojave County **State:** AZ

Request submitted by: FERC Kenneth A. Williams

Date Received: 12-14-81 **Additional information received:** 12-29-81;1-4-82

Name of property	Eligibility SHPO opinion	Eligibility Secretary of the Interior's opinion	Criteria
AZ:F:8:47	eligible	eligible	D
AZ:F:8:48	"	"	"
AZ:F:8:49	"	"	"
AZ:F:8:50	"	"	"
AZ:F:8:53	"	"	"
AZ:F:8:55	"	"	"

The above sites are significant for their potential to yield important information on the antecedants of the Hualapai tribe, and on settlement/subsistence systems through time as correllated with prehistoric precipation pattern changes.

for Keeper of the National Register

Date: 1/12/82

WASO-27

APPENDIX F
AVAILABLE SALT ANALYSES

ANALYSIS OF CORES FROM RED LAKE 1 (STRATOGRAPHIC TEST) MOHAVE COUNTY, ARIZONA

PHASE I AND II

DICKINSON LABORATORIES, INC.

ASSAYERS — CHEMISTS — METALLURGISTS

801 N. CLARK
P. O. BOX 10097
EL PASO, TEXAS 79991

772-3038 — 772-8931

November 17, 1970

El Paso Natural Gas Company
P. O. Box 1492
El Paso, Texas 79999

Re: Analysis of Cores from Red Lake 1
(Stratographic Test) Mohave County,
Arizona. Phase I and II
Order # 2259, Req.# NC 233

Gentlemen:

At your request chemical and physical tests have been performed on the above core samples. Both Phase I and Phase II are tabulated on the following pages for your review.

If there are any questions pertaining to the enclosed reports, we would appreciate the opportunity to review and clarify.

Respectfully submitted,

DICKINSON LABORATORIES, INC.

George G. Dickinson

GGD/sj

Enclosure: (1) Phase I
(2) Phase II

DICKINSON LABORATORIES, INC. ASSAYERS — CHEMISTS — METALLURGISTS

201 N. CLARK
P. O. BOX 10087
EL PASO, TEXAS 79991

915-532-3439 — 915-532-3431

November 17, 1970
El Paso Natural Gas Company

Enclosure: (1) Phase I

1. Eight core samples submitted for analysis were sawed by splitting core in two (sawing was parallel to core walls).

2. Eight core samples were prepared for analysis.
   (1) Crushing
   (2) Pulverizing
   (3) Drying

3. Water content on eight samples.
   (1) Moisture was made from crushed sample prior to pulverizing.
   (2) Water of hydration was made from pulverized sample after drying.

(1) Moisture in Percent.

[illegible]	4014	4046	4077	4106	5015	5041	5039	5036
	0.33	0.28	0.25	0.22	0.27	0.28	0.23	0.22

Water of Hydration in Percent

[illegible]	4014	4046	4077	4106	5015	5041	5039	5036
	0.38	0.16	0.16	0.08	0.18	0.17	0.27	0.14

4. Semi-Quantitative Analysis (Emission Spectrographic) on eight samples (gross sample) and evaluation for further studies.
   (1) None of the rare earth elements were found present in higher concentrations than the spectrograph's detection limits under the given conditions.

A preliminary study of semi-quantitative spectrographic analysis, for rare earths, was conducted on the samples marked Red Lake, numbers 4014, 4046, 4077, 4106, 5015, 5041, 5039 and 5036.

Sample Preparation

Spectrographic samples were prepared by mixing 900 mgs of spec-pure Li_2CO_3 (to act as buffer) and 50 mgs of the Red Lake pulverized sample. Weights of 10, 20 and 30 mgs of the above mixture were placed in crater cup graphite electrodes. Counter electrode was a rounded graphite rod.

Standards

The rare earth Spex L Standards were used and treated exactly like the unknown samples. Their concentrations were:

L-1	0.5 %
L-2	0.05 %
L-3	0.005 %
L-4	0.0005 %

of the following elements: Ce, Dy, Er, Eu, Gd, Ho, La, Lu, Nd, Pr, Sc, Sm, Tb, Tm, Y, Yb.

DICKINSON LABORATORIES, INC. ASSAYERS — CHEMISTS — METALLURGISTS

201 N. CLARK
P. O. BOX 10087
EL PASO, TEXAS 79991

772-3088—772-9841

November 17, 1970
El Paso Natural Gas Company

Enclosure: (1) Phase I

Apparatus and Spectrographic Operating Conditions

Electrodes - Lower (anode) .242" dia. graphite rod with 30 mg crater capacity.

Electrodes - Upper (cathode) .242" dia. graphite rod, rounded.

Analytical Gap - 5 mm

Excitation - D. C. Arc 220 v 7 amps

Spectrograph - Bausch & Lomb Double Grating
Wavelength - 3900-4300 and 2500-3500 A
Slot Width - 20u
Sector - None
Filter - None

Exposure Time - 60 to 135 seconds

Photographic Emulsion - S.A. #1

Developer - D-19, 4 min. at 70°C

Results and Conclusion

Table I shows the choice analytical lines of all the rare earth elements under study.

None of the rare earth elements were found to be present in higher conc. than the spectrograph's detection limits under the given conditions.

If necessary, more elaborate and refined techniques in emission spectroscopy could be investigated to try to lower the detection limits for the rare earths under study, but probably X-Ray emission could provide better sensitivites and an easier approach.

DICKINSON LABORATORIES, INC. ASSAYERS — CHEMISTS — METALLURGISTS

201 N. CLARK
P. O. BOX 10087
EL PASO, TEXAS 79991

915-533-3393—915-533-3821

November 17, 1970
El Paso Natural Gas Company

Enclosure: (1) Phase I

TABLE I

Element	Wavelength	Li_2CO_2 Sensitivity %	
Co	3952.54	.05	(Less than)
	4012.39	.03	" "
Dy	4221.10	.003	" "
Er	4007.97	.0003	" "
Eu	3111.43	.005	" "
Gd	4251.74	.003	" "
	4262.10	.003	" "
Ho	3456.00	.003	" "
La	3988.50	.005	" "
Lu	3472.40	.003	" "
Nd	4303.57	.005	" "
Pr	4222.98	.003	" "
Sc	4246.83	.0005	" "
	3907.48	.0003	" "
Sm	4424.34	.05	" "
	4434.32	.003	" "
Tb	4278.51	.003	" "
	4318.85	.003	" "
Tm	3761.33	.005	" "
	3761.92	.005	" "
	3462.20	.005	" "
Y	4309.63	.003	" "
	4543.70	.05	" "
	4674.85	.05	" "
Yb	3694.20	.001	" "
	20737.99	.0003	" "

DICKINSON LABORATORIES, INC. ASSAYERS — CHEMISTS — METALLURGISTS

201 N. CLARK
P. O. BOX 10057
EL PASO, TEXAS 79991

772-3088 — 772-6831

November 17, 1970
El Paso Natural Gas Company

Enclosure: (1) Phase I

(2) It is suggested that the following elements be evaluated: Na, K, Ca, Mg, Cl, Fe, Li, B, Mn, S, Al and Sr.

5. Percent Water Soluble and Water Insoluble on the eight samples are as follows:

Core Number	Percent Water Soluble	Water Insoluble
4014	96.925	3.075
4046	98.255	1.745
4077	98.797	1.210
4106	99.765	0.235
5015	99.155	0.845
5041	99.515	0.485
5059	97.390	2.610
5086	99.040	0.960

6. Gross Density on the eight samples are as follows: (Physical Test performed on portion of core returned to El Paso Natural Gas Co.).

Core Number	Gross Density in lbs/cu.ft.
4014	133.0
4046	132.7
4077	134.3
4106	132.8
5015	133.8
5041	133.6
5059	132.9
5086	133.4

DICKINSON LABORATORIES, INC. ASSAYERS — CHEMISTS — METALLURGISTS

801 N. CLARK
P. O. BOX 10087
EL PASO, TEXAS 79991

772-3088—772-6621

November 17, 1970
El Paso Natural Gas Company

Enclosure: (2) Phase II

As per your letter of October 19, 1970, phase II studies were conducted. Test results are as follows:

1.	5039		5085	
Na	36.890%		37.791%	
K	0.059%		0.038%	
Ca	0.160%		0.180%	
Mg	0.065%		0.022%	
Cl	58.691%		60.309%	
Fe	0.060%		0.030%	
Li	4.6 ppm		1.9 ppm	
B	50 ppm	Less than	50 ppm	Less than
Mn	0.029%		0.003%	
S	0.060%		0.080%	
Al	0.085%		0.021%	
Sn	0.002%	Less than	0.002%	Less than
CO_2	0.277%		0.369%	
Ce	0.0211%	Less than	0.0180%	Less than
Cb	0.0008%	Less than	0.0005%	Less than
La	0.0025%	Less than	0.0015%	Less than
Nd	0.0031%	Less than	0.0023%	Less than
Sc	0.0003%	Less than	0.0002%	Less than
Y	0.0035%	Less than	0.0021%	Less than
Yb	0.0005%	Less than	0.0002%	Less than
Insoluble	1.719%		0.709%	
	98.095		99.554	
	~~97.818~~		~~99.185~~	

2.	5015		5049	
Li	1.8 ppm		2.2 ppm	
B	50 ppm	Less than	50 ppm	Less than
S	0.016%		0.040%	

3.	4048
Fe	0.03%
CO_2	0.213%

2275.5C

DICKINSON LABORATORIES, INC.

ASSAYERS — CHEMISTS — METALLURGISTS

201 N. CLARK
P. O. BOX 10037
EL PASO, TEXAS 79991

772-3035 — 772-3631

November 17, 1970
El Paso Natural Gas Company

Enclosure: (2) Phase II

Methods Used

1. For Na, K, Ca, Mg, Fe, Mn, Al, Li and Sn. (Atomic Absorption)

2. For B (Colorimetric)

3. For Cl (Volumetric)

4. For CO_2 (CO_2 Analyzer)

5. For S (Gravimetric and Volumetric)

6. For the rare earths an X-Ray Emission Spectrograph

Institute for Environmental Studies
Room 42 Atkinson Hall

LOUISIANA STATE UNIVERSITY AND AGRICULTURAL AND MECHANICAL COLLEGE
BATON ROUGE · LOUISIANA · 70803 504/388-8521

September 23, 1980

RECEIVED
SEP 26 1980

Mr. Leo Van Der Horst
CER Corporation
4220 S. Maryland Parkway D-801
P. O. Box 15090
Las Vegas, NV 89114

Dear Leo,

As per our discussion yesterday, September 22, please find enclosed materials related to Red Lake salt tests and descriptions performed at LSU.

From our limited testing, it appears that Red Lake salt behaves generally similar to salt from other sources. However, I will sound a note of caution. The transport company that finally delivered the salt to us apparently had problems locating our laboratory. They claimed 5 attempts were made to deliver the cores, consequently I believe the cores were strongly shaken up prior to our working with them. Thus, we selected and tested the intact "survivors" of a relatively rough trip (which is a classic problem in rock testing).

The massive salt in situ may well display less strength because of averaging behavior over zones of weaker rock. These zones of weaker rock would not be represented in our tests if the original cores separated along them in transport.

I enjoyed our discussions in Houston and appreciated the dinner and materials you left with me. I will be happy to answer any questions your people may have for me in Minneapolis, and thank you for permitting us to work with the Red Lake salt. I hope the enclosed materials will be useful for your purposes.

Sincerely yours,

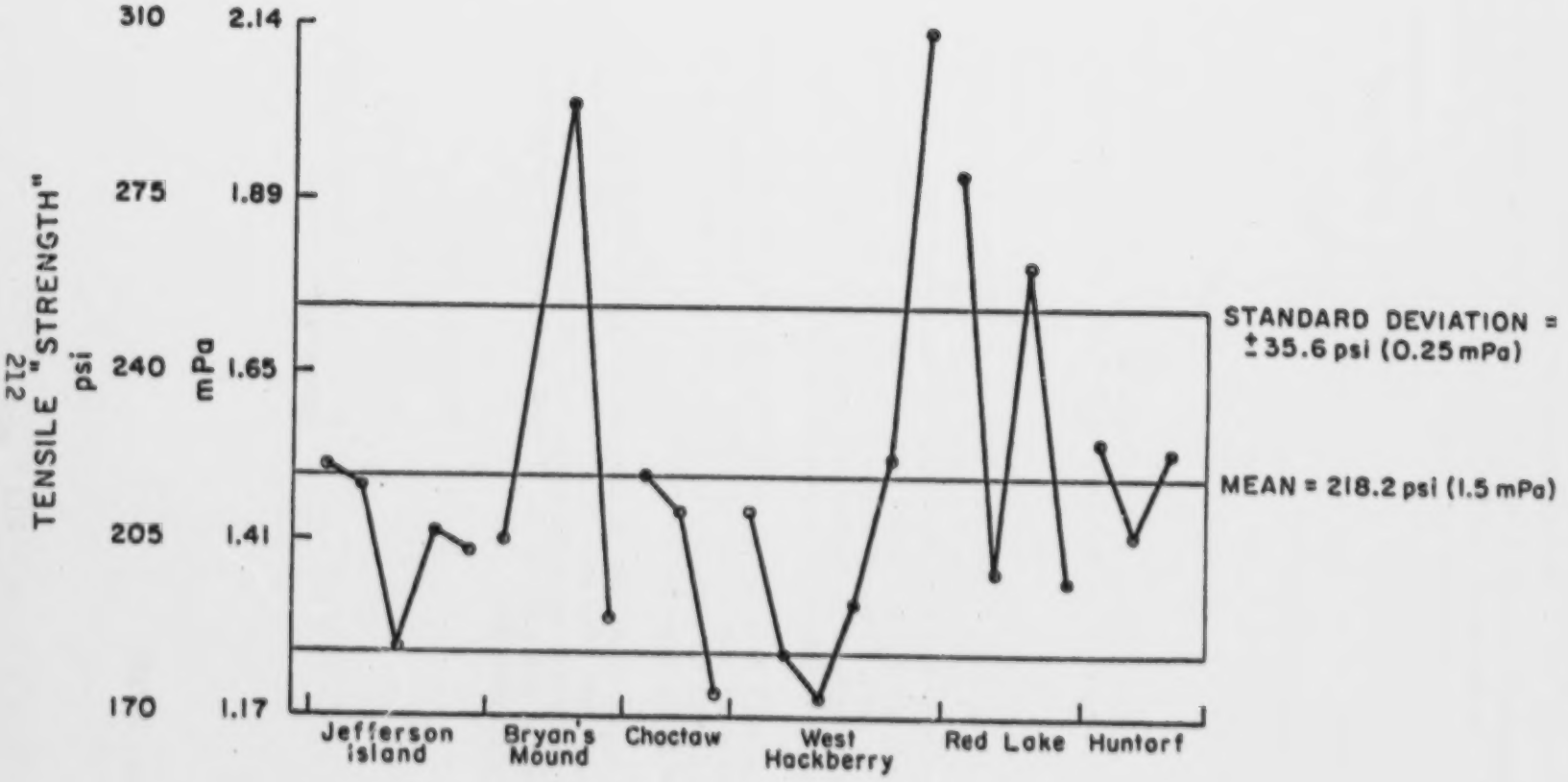
R. L. Thoms

R. L. Thoms, Senior Investigator
Geomechanics Group

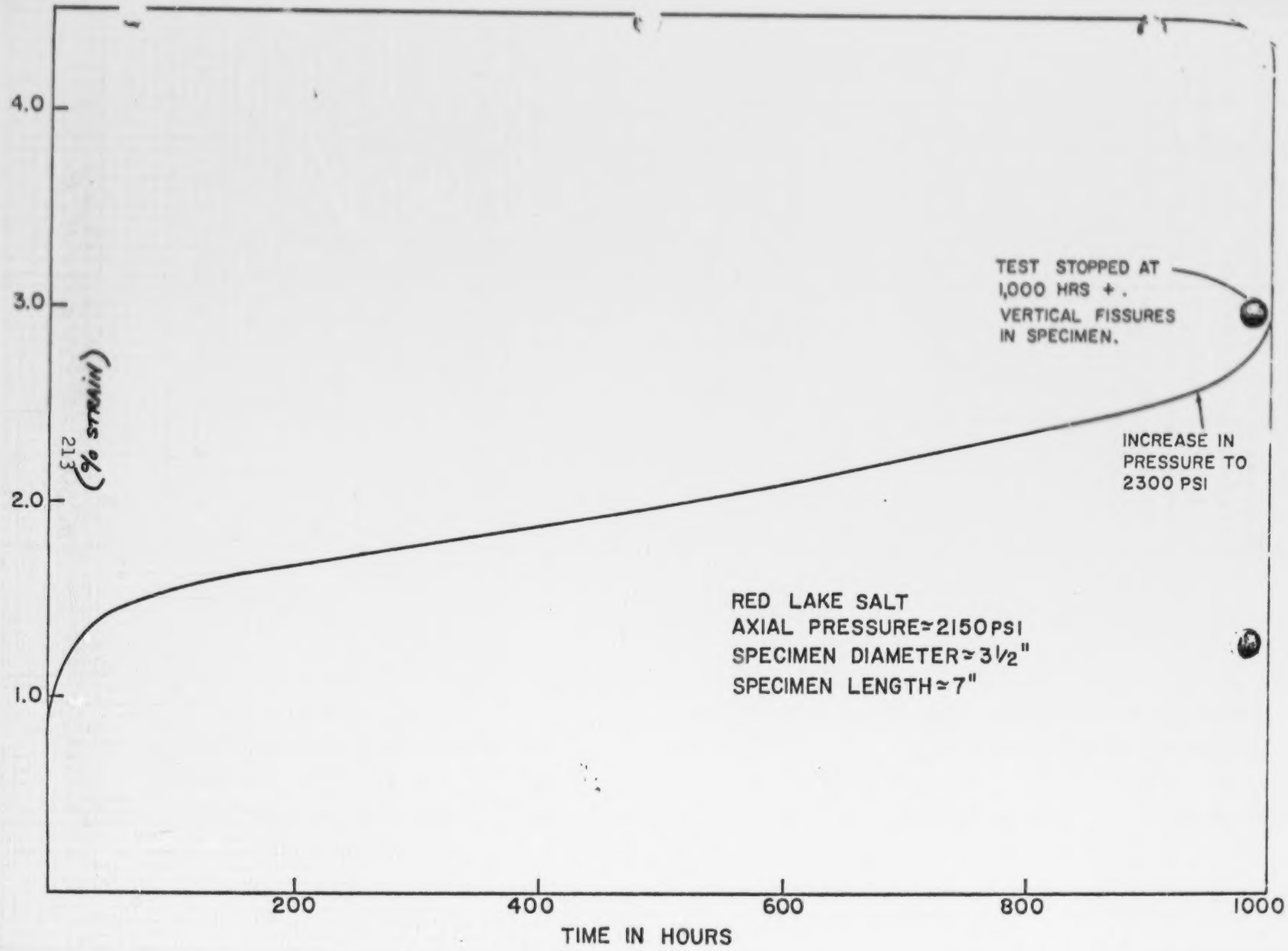
RLT:pb

Enclosures

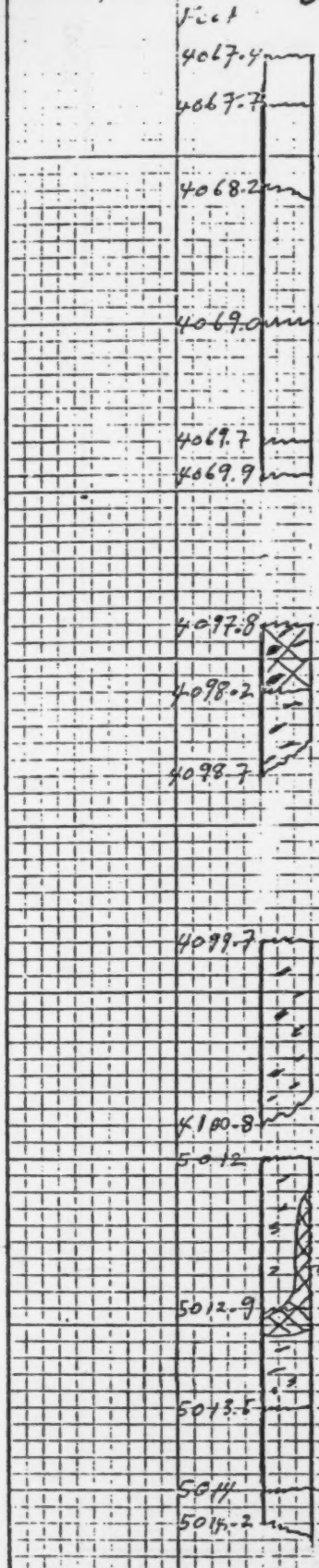
CC: H. Lorenzen, PB/KBB



BRAZILIAN TEST RESULTS FOR SALT FROM DIFFERENT SOURCES


4.0
3.0
2.0
1.0
(minus % strain)
213
TEST STOPPED AT
1,000 HRS +.
VERTICAL FISSURES
IN SPECIMEN.
INCREASE IN
PRESSURE TO
2300 PSI
RED LAKE SALT
AXIAL PRESSURE≈2150PSI
SPECIMEN DIAMETER≈3½"
SPECIMEN LENGTH≈7"
200
400
600
800
1000
TIME IN HOURS

Graphical Representation of Lake Salt Core



Medium to coarse grained (1-3cm), anhedral to subhedral halite with 10-20% mud inclusions (to 3cm) some of the mud inclusions are lenticular (5 x 1 cm) the opaque core has a reddish brown colour

Coarse-grained to megacrystalline, anhedral halite with mud inclusions (3.0cm). Some mud inclusions are lenticular (5.0 x 0.5 cm). The opaque core is 20% mud

Fine to medium grained halite with 30% mud inclusions which are often lense shaped (1 x 0.5 cm). Opaque core has a brown colour

Generally a fine-medium translucent halite with coarser grained patches of halite. Core is 30% mud which is planar occurs as layers however not in a consistent orientation. The mud gives the core a brownish colour. Individual crystal of halite appear very pure and are usually euhedral

Bottom of core is Halite

Graphical Presentation of Core Data

Feet

5053.3 core break — Clear transparent megacrystalline halite. Each piece of core is one crystal

5055.8 saw cut

5054.3 saw cut

5054.8 Fine-grained halite (1 to 0.5 cm) with a few coarser crystals (1 to 2 cm) in a 20% mud ground mass which occurs in a few distinct layers orientated at 55° to the core axis

5055.4

5055.8

5966.8 Megacrystalline halite with a few thin mud inclusions. Becomes coarse-grained, (1 to 4.0 cm) cloudy and opaque towards 5968 ft indicating an increase in the amount of mud core in places has a red tint

5967.1

5967.6

5968.2 Dark brown to black, mainly opaque core, mostly coarse-grained halite (1-3 cm) with mud

5968.5

5968.9

N505
S05
S05
S05

APPENDIX G
COMMENTS ON THE DEIS AND THE STAFF'S RESPONSES

United States Department of Agriculture

Soil Conservation Service

Room 3008, Federal Building
230 North First Avenue
Phoenix, Arizona 85025

October 16, 1981

RECEIVED BY
NOV 2 1981
ENVIRONMENTAL EVALUATION BRANCH

Mr. Kenneth F. Plumb
Secretary, Federal Energy Regulatory Commission
825 North Capitol Street, N.E.
Washington, DC 20426

Dear Mr. Plumb:

We have reviewed the DEIS-Red Lake Cavern Gas Storage Project and offer the following comment:

It is difficult to determine the full impact of this proposal. In several places in the DEIS it is pointed out that there is insufficient information to "conclusively assess the impact of the proposal" (page 123). Further analysis will correct this shortcoming.

The impact of wind-blown salt, on the soils and vegetation off the site, during operation and abandonment may be greater than indicated.

Acting for

Verne M. Bathurst
State Conservationist

218

Major deficiencies in the data used to prepare the DEIS have been resolved. Various changes have been made in the FEIS text. The FERC staff also recommends several conditions to the certificate which would further mitigate the environmental impact, should the Commission approve the project.

The Soil Conservation Service is an agency of the Department of Agriculture

SCS-10-71

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, CORPS OF ENGINEERS
P. O. BOX 2711
LOS ANGELES, CALIFORNIA 90053

SPLED-E

8 October 1981

Mr. Kenneth F. Plumb, Secretary
Federal Energy Regulatory Commission
825 North Capitol Street, N.E.
Washington, D.C. 20426

RECEIVED BY
OCT 20 1981
ENVIRONMENTAL EVALUATION BRANCH

Dear Mr. Plumb:

This is in response to a letter from your office dated 25 August 1981 which requested review and comments on the Draft Environmental Impact Statement (DEIS) for the Red Lake Salt Cavern Gas Storage Project, Docket No. CP 80-581.

The proposed plan does not conflict with existing or authorized plans of the Corps of Engineers. We note that the proposed storage facility is not within a flood hazard area.

The 100-year flood will cause minor flooding to the Stocking Hill Road at the northwest side of the lake during project construction. This flooding will be caused by fluctuations in the groundwater table at the evaporation ponds until such time as the ponds are sealed against water percolation, etc. Should you have any questions in these regards, please feel free to contact Mr. Vincent Vanni, telephone (213) 688-5420, and refer to Flood Plain Management File No. A-07-128.

Thank you for the opportunity to review and comment on this document.

Sincerely,

Robert S. Hall

NORMAN ARNO
Chief, Engineering Division

No response required.

219

GENERAL COUNSEL OF THE
UNITED STATES DEPARTMENT OF COMMERCE
Washington, D.C. 20230

OCT 19 1981

Honorable Kenneth F. Plumb
Secretary of the Federal Energy
Regulatory Commission
825 North Capitol Street, N.E.
Washington, D.C. 20426

Dear Mr. Secretary:

This is in reference to your draft environmental impact statement entitled "Red Lake Salt Cavern Gas Storage Project, Mohave County, Arizona - Docket No. CP80-501." The enclosed comment from the National Oceanic and Atmospheric Administration is forwarded for your consideration.

Thank you for giving us an opportunity to provide this comment, which we hope will be of assistance to you. We would appreciate receiving four copies of the final environmental impact statement.

Sincerely,

Robert T. Miki
Director of Regulatory Policy

Enclosure Memo from: Robert B. Rollins
National Ocean Survey
National Oceanic and Atmospheric Administration

No response required.

220

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SURVEY
Rockville, Md. 20852

August 31, 1981

TO: PP/EC - Joyce M. Wood

FROM: OA/C5 - Robert B. Rollins

SUBJECT: DEIS 8108.28 - Red Lake Salt Cavern Gas Storage Project, Mohave County, Arizona

The subject statement has been reviewed within the areas of the National Ocean Survey's (NOS) responsibility and expertise, and in terms of the impact of the proposed action on NOS activities and projects.

Geodetic control survey monuments may be located in the proposed project area. If there is any planned activity which will disturb or destroy these monuments, NOS requires not less than 90 days' notification in advance of such activity in order to plan for their relocation. NOS recommends that funding for this project includes the cost of any relocation required for NOS monuments. For further information about these monuments, please contact Mr. John Spencer, Director, National Geodetic Information Center (OA/C18) or Mr. Charles Novak, Chief, Network Maintenance Branch (OA/C172), at 6001 Executive Boulevard, Rockville, Maryland 20852.

A third-order leveling line of the U.S. Geological Survey is located along Stockton Hill Road.

The applicant has been informed of this requirement and has agreed to give the proper notice if any National Ocean Survey geodetic control survey monuments would be disturbed.

10TH ANNIVERSARY 1970-1980
National Oceanic and Atmospheric Administration
A young agency with a historic tradition of service to the Nation

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
LOS ANGELES AREA OFFICE
2500 WILSHIRE BOULEVARD
LOS ANGELES, CALIFORNIA 90057

REGION IX

OCT 14 1981

IN REPLY REFER TO:
9.2SS

Kenneth F. Plumb
Federal Energy Regulatory Commission
825 No. Capitol Street, N.E.
Washington, D.C. 20426

RECEIVED BY
NOV 5 1981
ENVIRONMENTAL EVALUATION BRANCH

Dear Mr. Plumb:

Subject: Red Lake Gas Storage System DEIS
Hualapai Valley
Mojave County, Arizona

A review has been completed of the subject Draft Environmental Impact Statement. Of particular interest to this office is in seeing an analysis in the EIS identifying extent or range of potential off-site noise and safety hazards that might be associated with the operation of such a facility.

It would provide guidance to an agency such as ours, in making decisions as to location of residential land uses in the vicinity of a gas storage facility, operating plant and/or high pressure gas transmission lines, if potential impact distances from such sources could be delineated. This delineation would cover:

1. Gas pipeline ruptures
2. Ruptures in the dikes forming the holding and evaporation ponds
3. Toxic fume emissions from the holding or evaporation ponds

As you may discern, our comments are basically inquiries as to the nature and extent of potential environmental impacts that would influence decisions as to location of housing when in the vicinity of a project such as yours.

Sincerely,

Ceferino Ahuero
Environmental Clearance Officer

RECEIVED
OCT 26 1981
DIVISION OF HYDROPOWER LICENSING

222

The applicant would be required to comply with all applicable DOT pipeline safety and design regulations under 49 CFR, part 192. These regulations specify safety measures such as pipe wall thickness, pipe yield strength, and maximum operating pressure, according to the category of population density traversed. If a gas pipeline ruptured, the resulting physical damage would normally be confined to the area immediately adjacent to or on the pipeline right-of-way. Once a pipeline is constructed, no permanent structures, other than pipeline facilities or perhaps other utilities, would be allowed within the 50-foot wide right-of-way. If a rupture occurred without ignition or explosion of the natural gas, the gas could migrate into nearby structures and explode if a source of ignition were present and if the proper air/fuel mixture were obtained. Further information on pipeline safety can be found in section 4.J of the FEIS.

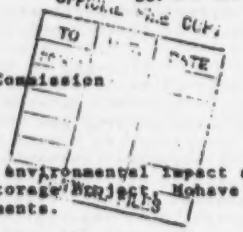
Brine could leak if the pond diking ruptured. This leak would be confined to the playa. A spill would dry up and deposit a salt crust on the playa surface. The staff recommends that such spills be cleaned up. Quality assurance in the construction of the pond diking and adherence to the staff's recommendations would minimize the potential for or impact from rupture of dikes and brine spills.

No highly toxic or hazardous substances would be emitted from the evaporation pond. Some LPG might escape from the caverns through the brine transfer pipeline. The toxicity threshold limit of propane (the primary constituent of LPG) is 1,000 ppm, and it enters the body by being inhaled. Therefore, if a toxic incident occurred, it would most likely involve plant personnel and not the general public. A flare stack at the end of the brine transfer line would preclude any such incident by burning any escaped LPG.

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

ER 81/1750



OFFICE OF THE SECRETARY
Oct 21 1 25 PM '81
FEDERAL ENERGY REGULATORY COMMISSION

Honorable Kenneth F. Plumb
Secretary
Federal Energy Regulatory Commission
Washington, D.C. 20426

Dear Mr. Plumb:

We have reviewed the draft environmental impact statement for the Red Lake Salt Cavern Gas Storage Project, Mohave County, Arizona, and have the following comments.

Soils

The inadequacy of existing soil test data has been recognized in the environmental statement. We also note that at no soil testing locality was sufficient information obtained to permit a reliable identification of soil type according to the Unified Soil Classification System, which would seem to be a minimum requirement for planning a project of this type. Conspicuously absent from the section on soils is adequate information on possible changes in grain size and soil type between the surface layer, described as clay to silty clay in the upper foot, and the underlying 3 feet of soil. The soil is tentatively described as soil type CH, but it has not been stated whether this is based on the surficial layer, on subsurface material, or a composite of the two. Significant changes are commonly observed between the uppermost layer (e.g., from the surface to a depth of 3 inches to 1 foot) and underlying soil in Great Basin playas. The surface layer is commonly a silty clay (e.g., soil type ML or CL-ML), whereas the subsurface is commonly clay containing less silt (e.g., soil type CL or CH). Such a change might account for a number of the observations described in figures 13 to 15. Useful information in planning depths of excavation for evaporation ponds and borrow material might be obtained by measuring Atterberg limits (liquid limit, plastic limit, and plasticity index) as well as reliably determining soil type for samples representative of intervals not over 6 inches from the surface to 30 inches or deeper; depth intervals should be smaller in depth ranges proposed for extensive excavation, such as the uppermost 1 1/4 and 2 1/4 inches.

Comments reflected in sections 3.D.2 and 4.C.2 of the FEIS.

Waste Ponds

We concur with the staff's position that the applicant's plan for the abandonment of the unsalable salt wastes would leave them likely to be scattered by surface waters. Also, the staff's alternative design for the ponds recommended for further study appears to provide for much better protection from long-term erosive forces.

No response required.

We also agree with the staff concerning the need for a comprehensive investigation of the crack system which has influenced parts of the playa in the past. We recommend that this investigation should include factors pertinent to possible initiation of additional large-scale fracturing. Thickness and characteristics of the fine-grained materials of the playa are needed, as are water levels (perched, artesian, or water-table) and moisture-content variations with depth. If a capillary fringe above the principal aquifer extends upward into the playa deposits, its extent will probably be very significant because it appears that downward movement of a capillary fringe may be important in the initiative of deep, large-scale fractures in playa deposits (e.g., Neal, J. T., Langer, A. M. and Kerr, P. F., 1968, Giant desiccation polygons of Great Basin playas: Geol. Soc. American Bull., v. 79, p. 86, 87).

The recommended investigations have been conducted to the satisfaction of the FERC staff. Results are reflected in the FEIS.

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Water Resources

We agree with the staff that the available hydrogeologic data are inadequate for an evaluation of the effects of the proposed project on ground-water resources of Hualapai Valley. Also, baseline data will be needed for future evaluation of impacts, if the project is undertaken and if additional caverns are to be created.

The FERC staff recommends a comprehensive groundwater monitoring program which would provide an early warning if any contamination occurred and develop baseline data for future evaluation of impact.

The final statement should address more thoroughly the probable hydraulic fracture gradient within any consolidated materials to be penetrated, including the halite--for both liquid and gas to be injected. We note that during operation the pressure changes may range from 1,000 to 3,000 psi, however, the proposed maximum down-hole pressures both for the freshwater injection during construction and for gas-storage operations should be discussed. The potential for induced hydraulic fracturing and related impacts on ground-water resources should be addressed more thoroughly. (See Katz, D. L., and Coats, K. H., 1968, Underground storage of fluids: Ann Arbor, Michigan, Ulrich's Books, Inc., p. 138-139)

Comments reflected in section 4.B.2 of the FEIS.

Because collapse of the caverns would probably affect ground-water resources, the possibility of its occurrence during construction, operation, and abandonment should be assessed and, if appropriate, mitigation proposed.

The top of the caverns would be at least 2,500 feet below the bottom of the principal aquifer. The FERC staff believes that proper testing of the solution mining wells before leaching operations begin and proper testing of the caverns before they are filled with gas, as proposed, would minimize the possibility of unanticipated collapse and groundwater impact. A separate filing under section 7(b) of the Natural Gas Act would be required to abandon the storage facilities. Environmental review, including cavern abandonment plans, would be done at that time.

Raptors

We note that present plans would employ on-site generation of electrical power rather than installing 26 miles of 69 kV trans-mission line. This would eliminate potential problems with raptors. If a powerline is proposed at some later date for this project, the Department would appreciate being contacted for possible measures to eliminate raptor problems and provided for potential raptor enhancement recommendations.

We hope these comments will be helpful to you in the preparation of a final statement.

Sincerely,

Bruce Blanchard, Director
Environmental Project Review

FILED
OFFICE OF THE SECRETARY
'81 FEB 21 PM 1
FEDERAL ENERGY REGULATORY COMMISSION

No response required.

1792(024)

October 15, 1981

Kenneth Plumb, Secretary
Federal Energy Regulatory Commission
825 North Capitol Street, N.E.
Washington, D.C. 20426

RECEIVED BY
DEC 4 1981
ENVIRONMENTAL EVALUATION BRANCH

RE: Docket No. CP80-581

Dear Mr. Plumb:

Our comments to the DEIS for the Red Lake Salt Cavern Gas Storage Project are as follows:

1. Page 11, 2nd Paragraph. The location, dimensions, construction materials and methods of the "unspecified floodwater diversion" should be stated. Impacts of the diversion should also be given in Chapter 4.

The smaller of the two proposed evaporation ponds has been relocated to the immediate west of the larger pond. (See figures 2 and 6.) The staff believes that this relocation negates the need to construct the diversion.

2. Page 17, 5th Paragraph. The specific locations, dimensions, and construction methods of the microwave site on Mt. Tipton should be stated so the impacts can be addressed in Chapter 4. There may be significant conflicts with this facility and wilderness values in Wilderness Study Area 2-12/42.

Construction of the communications towers would not be necessary until at least 1985. The reference to a site on Mount Tipton was only a hypothetical possibility. No final site has been selected, but the staff recommends that the applicant seek environmental review by the FERC staff once a site is selected.

3. Page 18, Future Plans. The 3rd paragraph states the DEIS "attempts to address the impacts of expansion which would be significantly more severe than those of the present proposal". The 2nd paragraph only provides a very general idea of what expansion would entail and nothing is quantified to lead one to the "severe" conclusion stated in paragraph 3. If future expansion is to be adequately assessed in the DEIS, as much specific information must be provided as possible at this time, e.g. when will it probably occur, where - surface and subsurface, will additional ancillary facilities be needed?

It is impractical to discuss the impact of expansion in much greater detail. The DEIS attempted only to give a general idea of what might occur and not to present a thorough assessment of potential impact. In brief, the pertinent issues are the impact of (1) possible groundwater withdrawls which are substantially greater than what is currently proposed, (2) longer term use of the evaporation pond and continued production of salt, and (3) increased likelihood of giant mud-crack development. These have been discussed in the appropriate sections of the FEIS. Also, see minor revisions in section 2.A.3.

4. Page 30, 5th Paragraph. We do not concur with the proposed road location as stated, and would like to discuss other possible locations as soon as possible.

No response required.

5. Page 71, 1st Paragraph. It is stated that "the zone-tailed hawk and the desert tortoise, both listed as threatened or sensitive by the State of Arizona, occur in the project area. An environmental report prepared by WESTEC Services, Inc., of Las Vegas, Nevada, concluded that the "desert tortoise would be expected to occur in low densities" and that the "zone-tailed hawk may periodically occur" in the project area. Neither of these state-listed species were sighted during WESTEC's field studies. We have not sighted nor do we have information that would indicate that the project site is occupied by either the desert tortoise, or zone-tailed hawk. We therefore request that the statement be changed to read "may occur in the project area."

Comment reflected in section 3.F.2 of the FEIS.

6. Pages 75 and 79. The "Recreation" section, referencing the North American Landsailing Association's (NALSA) request to utilize Red Lake as a landsailing park, requires clarification. NALSA requested that Southwest Gas exchange its land holdings in the north half of Red Lake to provide a consolidated block of public land which would be used exclusively for landsailing purposes. The following three points should be considered when evaluating BLM's position regarding NALSA's request:

   A) The ownership map on page 76 of the DEIS identifies private entities, other than Southwest Gas, who own land in the north half of Red Lake. Consummation of the NALSA request would therefore not result in the consolidation of a public land block in the north half of Red Lake.

   B) NALSA's request to require Southwest Gas to exchange their private holdings in the north half of Red Lake, could not be accepted as an exchange proposal when, in fact, NALSA has no private lands to offer. NALSA was acting as an interested party submitting an alternative to the initial Southwest Gas proposal as depicted on page 77 of the DEIS. NALSA's request will be discussed as an alternative when the environmental assessment for the Southwest Gas exchange is prepared.

   (C) The NALSA request proposes an exclusive use of the public land. BLM is mandated to manage the public lands and resources under the multiple-use concept. Public lands in the N½ of Red Lake have been identified for retention and will be considered for future recreational needs. A management plan may be developed to provide for public recreation needs, whether through cooperative agreements with private land owners or a land acquisition program. Further planning and assessment of public needs are necessary before a Red Lake park can be realized.

7. As stated in the "Conclusions and Recommendations" chapter, several significant technical problems still need to be resolved - soil suitability for pond construction, mechanical properties of salt in actual cavern areas, and aquifer dynamics. We trust this information will be available for development of the Final EIS.

Sincerely,

WILLIAM K. BARKER

DISTRICT MANAGER

FSplendiani:dr

No response required.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca. 94105

Project #D-FRC-K03009-AZ

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NOV 10 1981
ENVIRONMENTAL EVALUATION BRANCH

OCT 23 3 23 PM '81
FEDERAL ENERGY REGULATORY COMMISSION
FILED
OFFICE OF THE SECRETARY

Mr. Kenneth F. Plumb
Federal Energy Regulatory Commission
825 North Capitol Street, N.E.
Washington, D.C. 20426

Dear Mr. Plumb:

The Environmental Protection Agency (EPA) has received and reviewed the Draft Environmental Impact Statement (DEIS) titled RED LAKE SALT CAVERN GAS STORAGE PROJECT.

The EPA's comments on the DEIS have been classified as Category LO-2. Definitions of the categories are provided by the enclosure. The classification and the date of the EPA's comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed Federal Actions under Section 309 of the Clean Air Act. Our procedure is to categorize our comments on both the environmental consequences of the proposed action and the adequacy of the environmental statement.

The EPA appreciates the opportunity to comment on this DEIS and requests five copies of the Final Environmental Impact Statement when available.

If you have any questions regarding our comments, please contact Susan Sakaki, EIS Review Coordinator, at (415) 556-7858.

Cordially yours,

SONIA F. CROW
Regional Administrator

Enclosure

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NOV 2 1981
DIVISION OF HYDRO...
...

228

Water Quality Comments

The DEIS does not present sufficient data on hydraulic communication and hydrogeology in the Red Lake area to provide for an adequate assessment of the potential impacts on aquifer water quality and groundwater quality. The discussion of water resource impacts on pages 102-107 and the conclusions reached on pages 121-126 underscore this lack of data. The potential impacts due to groundwater overdraft and possible contamination from brine seepage cannot be fully assessed until further studies have been conducted. We concur with the recommendations provided on pages 123-126 which outline the areas recommended for further analysis prior to project approval.

The recommended investigations have been conducted to the satisfaction of the FERC staff. Results are reflected in the text.

Hazardous Waste Comments

The evaporation ponds are to be filled with a brine solution described as containing "a variety of inorganic compounds, primarily sodium chloride..." (page 11). The Final Environmental Impact Statement (FEIS) should present an analysis of the brine to determine the chemical nature of this solution. While a quantity of the 1.56 million tons of dried residue will be sold as crude sodium chloride, a substantial portion will be left in place in the evaporation ponds. The residue may contain significant concentrations of readily water soluble heavy metals.

Brine samples are not available for analysis since the Patnya salt cavern wells have not been drilled yet. Spectrographic and solubility analyses were conducted in 1970 on core samples taken from the El Paso well. These results are presented in appendix E. The applicant has since agreed to remove all of the salt residue after abandoning the pond site. The potential long-term hazard of saline and heavy metal containing leachate would therefore be avoided.

Air Quality Comments

1. Fugitive Dust

   Because of low soil moisture and high silt content, fugitive dust could be a serious problem during the construction phase. Attempts in the DEIS to quantify ambient concentrations resulting from dust emissions appear to be in error. The predicted ground level concentration of 9.08×10^{11} ug/day is not comparable with the Federal standard of 260 ug/m^3. The calculations on page 89 showing regional dust impacts of 1.5 ug/m^3 are misleading. The assumption that the dust would immediately and uniformly disperse into an air parcel 12.5 miles long and 1650 feet high is optimistic even during favorable dispersion conditions. These calculations should be modified or deleted.

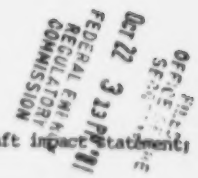
Since there is no approved air model for calculating dust dispersion generated by construction vehicles or construction activities, this fugitive dust analysis has been deleted. The analysis is valid only when uniform dispersion is expected to occur in Hualapai Valley. Actually, the maximum ground-level concentration, not TSP concentration, would occur at the construction site. The maximum ground-level concentration on any given day would depend on soil moisture, construction activities, and wind direction and velocity.

2. Compressor Station Impacts

   Modeling of annual average NO_2 impacts using the PTMAX model is not appropriate, since PTMAX is designed to compute only short-term average concentration. An appropriate EPA-approved annual model, such as CRSTER or Valley, should be used in any subsequent PSD permit application.

The PTMAX program is used only as a screening model to determine if a potential violation of the NAAQS would occur for the criteria pollutant in question. The appropriate annual model for mainline natural gas compressor stations is the Industrial Source Complex model. This model has been used in the FEIS.

EIS CATEGORY CODES



Environmental Impact of the Action

LO--Lack of Objections

EPA has no objection to the proposed action as described in the draft impact statement; or suggests only minor changes in the proposed action.

ER--Environmental Reservations

EPA has reservations concerning the environmental effects of certain aspects of the proposed action. EPA believes that further study of suggested alternatives or modifications is required and has asked the originating Federal agency to reassess these aspects.

EU--Environmentally Unsatisfactory

EPA believes that the proposed action is unsatisfactory because of its potentially harmful effect on the environment. Furthermore, the Agency believes that the potential safeguards which might be utilized may not adequately protect the environment from hazards arising from this action. The Agency recommends that alternatives to the action be analyzed further (including the possibility of no action at all).

Adequacy of the Impact Statement

Category 1--Adequate

The draft impact statement adequately sets forth the environmental impact of the proposed project or action as well as alternatives reasonably available to the project or action.

Category 2--Insufficient Information

EPA believes that the draft impact statement does not contain sufficient information to assess fully the environmental impact of the proposed project or action. However, from the information submitted, the Agency is able to make a preliminary determination of the impact on the environment. EPA has requested that the originator provide the information that was not included in the draft statement.

Category 3--Inadequate

EPA believes that the draft impact statement does not adequately assess the environmental impact of the proposed project or action, or that the statement inadequately analyzes reasonably available alternatives. The Agency has requested more information and analysis concerning the potential environmental hazards and has asked that substantial revision be made to the impact statement.

If a draft impact statement is assigned a Category 3, no rating will be made of the project or action, since a basis does not generally exist on which to make such a determination.

ARIZONA DEPARTMENT OF HEALTH SERVICES

Inter-Office Memorandum

REF: TS 0307

TO: Tibaldo L. Canez, Chief
Bureau of Waste Control

DATE: November 9, 1981

THRU: Alan L. Roesler, Manager ALR
Technical Support Section

FROM: Bill Hudson, PHEA
Technical Support Section W.H.

RE: Red Lake Salt Cavern Gas Storage Project - Draft EIS

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DEC 2 1981
ENVIRONMENTAL EVALUATION BRANCH

In this project, a salt formation underlying an area adjacent to Red Lake (a playa) is proposed to be solution mined in order to form a cavern for natural gas storage. The storage is needed for peak-use periods.

Of concern to the Bureau are the lagoons, in which the resultant brine will be located, in the Red Lake playa. After evaporation, part of the salt will be sold. However, there will be an unsaleable salt-clay mixture at the bottom of the evaporation lagoons. This is proposed to be buried in place.

Since the applicant now proposes to remove all of the salt residue after abandoning the pond site, the long-term impact of permanent salt disposal is a null issue.

The design of the lagoons has not yet been finalized. However, some difficulty in the construction is expected. If the height of the berms exceeds 6 feet, the Department of Water Resources, Division of Safety of Dams will perform a review. The bottom of the lagoons will be constructed of compacted clay, available on site. A laboratory remolded permeability test, at 90% compaction, gave a value of 10^{-9} cm/sec; the material will be excellent for lining the lagoons.

See response to comments on page 3 of the letter from the Arizona Game and Fish Department.

A permits-and-authorizations-required table in the draft EIS mentions ADHS, but does not mention the approval required to bury the salt. I suggest that this requirement be brought to the attention of the Federal Energy Regulatory Commission, the author of the document.

Upon operation of the gas storage facility, the gas will be stripped of entrained hydrocarbon liquids by a filter separator when leaving the storage cavern. The liquids are proposed to be stored on site until subsequent sale or disposal. The hydrocarbons, if listed, may be regulated under the hazardous waste regulations.

WH:mc

231

BRUCE BABBITT, Governor
Commissioners:
WILLIAM H. BEERE, Prescott, Chairman
CHARLES F. ROBERTS, O.D., Safford
FRANK FERGUSON, JR., Yuma
FRANCES W. WERNER, Tucson
CURTIS A. JENNINGS, Scottsdale
Director
WILD BRESTOW
Deputy Director
ROGER J. GRUENEWALD

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OFFICE OF THE
SECRETARY
Oct 21 12 51 PM 1981
FEDERAL ENERGY
REGULATORY COMMISSION

ARIZONA GAME & FISH DEPARTMENT
~~2222 West Greenway Road~~ Phoenix, Arizona 85023 942-3000
~~CO426~~ 5000 West Beale Street, Kingman, Arizona 86401

October 19, 1981

RECEIVED BY
NOV 4 1981
ENVIRONMENTAL EVALUATION
BRANCH

Mr. Kenneth F. Plumb, Secretary
Federal Energy Regulatory Commission
825 North Capitol Street, N.E.
Washington, D.C. 20426

Dear Mr. Plumb:

In response to the Federal Energy Regulatory Commission (FERC) Draft Environmental Impact Statement (DEIS) concerning the Red Lake Salt Cavern Gas Storage Project, Docket No. CP80-581, the following comments are provided.

The Arizona Game and Fish Department supports the FERC environmental staff's conclusion that further study is necessary to accurately assess the potential environmental impacts of this proposal. We believe these studies should be conducted and their results evaluated prior to construction of these facilities.

Specific comments on the DEIS are presented as follows:

Page 5, Paragraph 2:

From the cavern dimensions provided, we calculate the total combined active cavern volume to equal 45 million cubic feet (22.5 mcf per cavern).

Page 8, Paragraph 2:

We believe there is a potential for adverse impacts resulting from the use of liquefied petroleum gas (LPG) as a blanket system. If LPG is pumped into the evaporation ponds with the brine solution, waterfowl using these ponds may suffer from contact with the LPG.

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AN EQUAL OPPORTUNITY AGENCY

232

The numbers presented in the DEIS are approximations. The caverns would approach a cylindrical configuration terminated at the top and bottom by cone-shaped areas. The projected cavern dimensions would be more precisely described as approximately 130 feet in diameter and approximately 1,200 feet from top to bottom (including a 250-foot high cone-shaped "sump" at the bottom for collection of insolubles). The combined active volume for both caverns would be 23.4 million cubic feet. The staff cannot duplicate the computations presented in this comment.

A 30-feet high flare stack would be located at the end of the brine discharge line to burn any LPG whigh might escape. Continuous monitoring of the brine density at the plant site would allow detection of LPG in the brine, and corrective measures would be implemented to minimize LPG loss.

Waterfowl use of the pond is expected to be minimal, since the brine would be highly concentrated and no aquatic organisms are expected to thrive in it.

Page 8, Paragraphs 3 and 4:

Using the pumping rate provided, it is not possible to yield 1.6 billion gallons of water over a 14-month period, as proposed. Pumping at a rate of 1,500 gallons per minute, continuously (24 hours/day) for 14 months, would only yield .9 billion gallons of water. Therefore, we anticipate cavern development to require either 25 months of continuous groundwater withdrawal or a significant increase in the pumping rate.

The 1,500 gpm is the approximate required freshwater flow rate per cavern. Fourteen months is the entire cavern development time, which includes at least 50 days for conducting downhole sonar surveys and other nonleaching activities.

Revised estimates indicate a total groundwater requirement of 1.31 billion gallons to leach the two caverns.

Page 11, Paragraph 1:

Through correspondence with Dr. Dennis M. Kubly, Arizona State University, we believe that the 1.6 billion gallons of water required to develop the two caverns may be a gross underestimate. Using the figures provided in the DEIS of 1.6 billion gallons of water yielding 1.56 million tons of salt, we calculate that the brine contains 19% salt on a weight/weight basis. Assuming the salt is 100% halite, the brine will be 68% saturated. If less soluble impurities (e.g. gypsum - solubility in water equals 1.93 g/kg of water as compared to that of halite 357 g/kg of water) occur in the solute, this percent saturation would increase substantially, requiring a significant increase in the groundwater demand (Kubly, personal communication).

Indeed, the predicted concentration of produced brine would vary from 18 to 25 percent by weight. Also, the cavern design volume assumes that 5 to 7 percent of the material within the cavern spaces is insoluble and would be accommodated at the bottom of each cavern without sacrificing gas storage space. This assumption is conservative, since earlier solubility tests on El Paso core specimens from the 4,000- to 5,000-foot interval yielded insolubles of 0.235 to 3.075 percent. (See appendix F.)

Also see responses to the letter of comment from Dennis M. Kubly.

Page 17, Paragraph 5:

The microwave tower on Mount Tipton, if installed by vehicles, may impact the resident mule deer population by increasing access in the area. To mitigate this concern, we recommend this tower be installed by helicopter.

Installation of the communication towers would not be necessary until sometime in 1985. The sites have not been selected yet, but if a tower is constructed on Mount Tipton, the applicant indicates that consideration would be given to installation by helicopter.

Pages 21-24:

Our Department supports the implementation of the alternative evaporation pond design developed by the FERC environmental staff. However, we believe the following two features should be added to the alternative design:

- An impermeable membrane liner should be placed over the salt residue before encasing it in 24-30 inches of clay.
- The evaporation ponds should be fenced to preclude access by wildlife.

Since the applicant now proposes to remove all of the salt residue after abandoning the pond site, the long-term impact of permanent salt disposal is a null issue. Accordingly, the FERC staff has withdrawn its recommended pond design in favor of the environmentally superior alternative of total salt recovery.

Wildlife do not use the site of the proposed evaporation ponds extensively, especially those species which could be precluded by fencing. Therefore, the environmental staff does not believe it is necessary to recommend fencing the pond site.

Without the use of an impermeable membrane cover over the salt residue, rainwater could percolate through the clay cover and contact the salt deposit. The resulting brine could then be transported to the surface of the clay cover by capillary action. After drying, the remaining salt would be distributed into the environment by wind action.

The fencing around the evaporation ponds is necessary to prevent wildlife from ingesting toxic quantities of salt water and to prevent entrapment of wildlife in the 12 feet of solution by the steep interior slopes of the 13 feet high dikes.

The planned dike height is 4.5 feet, not 13 feet, and provides for an anticipated maximum brine depth of 1 to 2 feet rather than 12 feet. Also, see last response on previous page.

Page 70, Top of Page:

The antelope population occurring in Hualapai Valley is probably a resident population, remnant of historically larger herds, rather than transient individuals. Hualapai Valley is considered historic antelope habitat where large herds were consistently sighted (Davis, 1973).

Comment reflected in section 3.F.1 of the FEIS.

Page 97, Paragraph 3:

Salt contamination of the adjacent lands should not occur, regardless of whether or not Pataya obtains permission from the adjacent landowners to contaminate these lands.

No response necessary.

Page 108, Paragraph 3:

A citation of literature describing cases where bird mortality resulted from bird use of evaporation ponds would be helpful in evaluating the potential for mortality at Red Lake.

The incidences of waterfowl cited in the text were not published accounts but were reported to the Commission staff by Mr. Al Regenthal, waterfowl biologist, Utah Fish and Game Commission. Mr. Regenthal indicated that there is little waterfowl use of the salt evaporation ponds near Salt Lake City but that occasionally dead birds are found at the ponds.

Page 109, Paragraph 1:

An active ferruginous hawk nest occurs in Truxton Wash south of Red Lake.

Comment reflected in section 3.F.1 of the FEIS.

Page 119, Paragraph 3:

The plant's freshwater reservoir should be fenced to preclude access by wildlife to avoid entrapment.

The entire plant site (cavern/compressor site) would be fenced.

Pages 123 and 124:

Our Department believes the proposed further study should include investigation of the continuity of the cavern walls prior to the storage of liquid natural gas. Faults and fractures in the halite, subjected to an internal pressure of 1,000 to 3,000 pounds per square inch, could result in accidental rupture of the caverns and contamination of the groundwater.

The solution mining wells would be completed and pressure tested before any leaching. The caverns would be pressure tested before being filled with gas. The storage pressure would be lower than the in situ lithostatic pressure. If uncorrectable conditions occur, a new site would be selected or the project would be abandoned. No liquid natural gas is involved. See section 4.B.2. The principal aquifer in the valley lies at least 2,500 feet above the top of the proposed caverns.

Page 125, Paragraph 6:

Our Department would like to obtain, for our review, copies of Pataya's semi-annual operational reports as they are made available to the FERC.

Copies of these reports would be available through the FERC's Division of Public Information, 825 North Capitol Street, Washington, D.C. 20426. Alternatively, the applicant may be willing to supply copies, if requested.

Thank you for the opportunity to comment on this document.

Sincerely,

Bud Bristow, Director

Steve K. Forrell (SKF)
Habitat Evaluation Specialist
Kingman Regional Office

SKF:dd

cc: Don Metz, U.S.F.W.S., Phoenix
State Clearinghouse, AZ 81-80-0056
Planning and Evaluation Branch, Phoenix

ARIZONA
OFFICE OF THE GOVERNOR
BRUCE BABBITT

OFFICE OF
ECONOMIC PLANNING AND DEVELOPMENT

Larry Landry, Director • (602) 255-5371 • General Offices of OEPAD • 4th Floor

Nov 30 12 57 PM '81

FEDERAL AGENCIES
REGULATORY
COMMISSIONS

OFFICAL FILE COPY

TO	INIT.	DATE
DOCKET		
CENTRAL FILES		

MEMORANDUM

TO: Applicant

FROM: Arizona State Clearinghouse

DATE: NOV 25 1981

RE: Comment After Signoff CP80-581

Enclosed is a copy of a response, concerning the attached project, which was received by us after our Signoff to you.

A copy of the response is to be forwarded to the Federal Agency.

RECEIVED BY
DEC 2 1981
ENVIRONMENTAL EVALUATION BRANCH

Mailing Address: Executive Tower Room 505 • 1700 West Washington • Phoenix, Arizona 85007

SIGNOFF

OMB Approval No. 29-R0218

FEDERAL ASSISTANCE

2. Applicant's application — a. Number: — b. Date: 19 (Year Month day)

3. State application identifier — a. Number: AZ 81-80-0056 — b. Date Assigned: 19 81 09 21

1. Type Of Action (Mark appropriate box): ☐ Preapplication ☐ Application ☐ Notification Of Intent (Opt.) ☐ Report Of Federal Action

Leave Blank: OCT 19 1981

Section I - Applicant / Recipient Data

4. Legal Applicant/Recipient
a. Applicant Name: Federal Energy Regulatory Comm.
b. Organization Unit:
c. Street/P.O. Box: 825 N. Capitol Street, N. E.
d. City: Washington
e. County:
f. State: D. C.
g. Zip Code: 20426
h. Contact Person (Name & telephone no.): Secretary

5. Federal Employer Identification No.:

6. Program (From Federal Catalog) — a. Number: 9|9|.|9|9|9 — b. Title: Unknown

Federal Energy Regulatory Commission

7. Title and description of applicant's project: Red Lake Salt Cavern Gas Storage Project-Draft Environmental Impact Statement-Pataya Storage Co.-Docket No. CP 80-581

This Draft Environmental Impact Statement analyzes the environmental effects of the proposed Red Lake Gas Storage System in Mohave Co., Arizona, a gas storage field composed of two subsurface solution mined salt cavities, 30 miles of 16 in. diameter gas pipeline, an onsite electric generator (over

8. Type of applicant/recipient (A–State, B–Interstate, C–Substate District, D–County, E–City, F–Other Special Purpose District, G–Independent School District, H–State Controlled Institution of Higher Education, I–Private University, J–Private Nonprofit, K–Indian Tribe, L–Individual, M–Profit Organization, N–Community Action Agency, O–Other): Federal Agency

(Specify): Enter appropriate letter(s)

9. Type of assistance (A–Basic Grant, B–Supplemental Grant, C–Loan, D–Insurance, E–Other): Enter appropriate letter(s)

10. Area of project impact (Names of cities, counties, states, etc.): Mohave County, Arizona

11. Estimated number of persons benefiting:

12. Type of application (A–New, B–Renewal, C–Revision, D–Continuation, E–Augmentation): Enter appropriate letter

13. Proposed Funding

a. Federal	$ .00
b. Applicant	.00
c. State	.00
d. Local	.00
e. Other	.00
f. Total	$ .00

14. Congressional Districts Of: a. Applicant — b. Project: 03

15. Type of change (A–Increase Dollars, B–Decrease Dollars, C–Increase Duration, D–Decrease Duration, E–Cancellation, F–Other Specify): Enter appropriate letter(s)

16. Project Start Date (Year month day): 19

17. Project Duration: Months

18. Estimated date to be submitted to federal agency (Year month day): 19

19. Existing federal identification number:

20. Federal agency to receive request (Name, city, state, zip code):

21. Remarks added: ☐ Yes ☐ No

Section II - Certification

22. The Applicant Certifies That: a. To the best of my knowledge and belief, data in this preapplication/application are true and correct, the document has been duly authorized by the governing body of the applicant and the applicant will comply with the attached assurances if the assistance is approved.

b. If required by OMB Circular A-95 this application was submitted, pursuant to instructions therein, to appropriate clearinghouses and all responses are attached:

	No response	Response attached
(1) Arizona State Clearinghouse	☐	☒
(2) Region IV Clearinghouse (Dist IV)	☐	☒
(3)	☐	☐

23. Certifying representative — a. Typed name and title — b. Signature — c. Date signed (Year month day): 19

Section III - Federal Agency Action

24. Agency name

25. Application received (Year month day): 19

26. Organizational Unit

27. Administrative office

28. Federal application identification

29. Address

30. Federal grant identification

31. Action taken: ☐ a. Awarded ☐ b. Rejected ☐ c. Returned for amendment ☐ d. Deferred ☐ e. Withdrawn

32. Funding

a. Federal	$ .00
b. Applicant	.00
c. State	.00
d. Local	.00
e. Other	.00
f. Total	$ .00

33. Action date (Year month day): 19

34. Starting date (Year month day): 19

35. Contact for additional information (Name and telephone number)

36. Ending date (Year month day): 19

37. Remarks added: ☐ Yes ☐ No

38. Federal agency A-95 action: A. In taking above action, any comments received from clearinghouses were considered. If agency response is due under provisions of Part 1, OMB Circular A-95, it has been or is being made.

b. Federal Agency A-95 Official (Name and telephone number)

424-101

Standard Form 424 Page 1 (10-77)

Prescribed by O.M.B. Federal Management Circular 74-7

237

TO:

State Application Identifier (SAI)

SEP 21 1981 State A/I No. 81-80-0051

Dr. James Sam, M.D., Director
Department of Health Services
1740 West Adams Street
Phoenix, AZ 85007

Az. for Jobs & Energy
Corporation Comm.
Az. Natural Heritage Prog.
Energy
Mineral Res.
Game & Fish
Transportation
Ag. & Hort.
Mine Inspector
Radiation Regulatory Agency
Az Solar Energy Comm.
Oil & Gas Cons. Comm.

Power
Health
Water
Land
Parks

Region IV

FROM: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

NOV 30 12 30 PM 1981
FEDERAL ENERGY REGULATORY COMMISSION
FILES
OFFICE OF THE SECRETARY

This project is referred to you for review and comment. Please evaluate as to the following questions. After completion, return THIS FORM AND ONE XEROX COPY to the Clearinghouse no later than 17 WORKING DAYS from the date noted above. Please contact the Clearinghouse at 255-5004 if you need further information or additional time for review.

☐ No comment on this project ☐ Proposal is supported as written ☒ Comments as indicated below

1. Is project consistent with your agency goals and objectives? ☐ Yes ☐ No ☐ Not Relative to this agency

2. Does project contribute to statewide and/or areawide goals and objectives of which you are familiar? ☐ Yes ☐ No

3. Is there overlap or duplication with other state agency or local responsibilities and/or goals and objectives? ☐ Yes ☐ No

4. Will project have an adverse effect on existing programs with your agency or within project impact area? ☐ Yes ☐ No

5. Does project violate any rules or regulations of your agency? ☐ Yes ☐ No

6. Does project adequately address the intended effects on target population? ☐ Yes ☐ No

7. Is project in accord with existing applicable laws, rules or regulations with which you are familiar? ☐ Yes ☐ No

Additional Comments (Use back of sheet, if necessary):

No response required.

Reviewers Signature Pamela Williamson Date 11/19/81

Title Tech. Assist/EHS Telephone 1134

major

SIGNOFF

OMB Approval No. 29-R0218

FEDERAL ASSISTANCE

RECEIVED BY

2. Number
a. Number
b. Date

NOV 2 1981

3. State application identifier

a. Number AZ 81-80-0056
b. Date Assigned 19 81 09 21

1. Type Of Action (Mark appropriate box)
- ☐ Preapplication
- ☐ Application
- ☐ Notification Of Intent (Opt.)
- ☐ Report Of Federal Action

Leave blank OCT 1 1981

Petra Lisa Lyba

Section I - Applicant / Recipient Data

4. Legal Applicant/Recipient
a. Applicant Name : Federal Energy Regulatory C mm.
b. Organization Unit :
c. Street/P.O. Box : 825 N. Capitol Street, N. E.
d. City : Washington
e. County :
f. State : D. C.
g. Zip Code : 20426
h. Contact Person (Name & telephone no.) : Secretary

5. Federal Employer Identification No.

6. Program (From Federal Catalog)
a. Number 9 9 . 9 9 9
b. Title Unknown
Federal Energy Regulatory Commission

7. Title and description of applicant's project: Red Lake Salt Cavern Gas Storage Project-Draft Environmental Impact Statement-Pataya Storage Co.-Docket No. CP 80-581)

This Draft Environmental Impact Statement analyzes the environmental effects of the proposed Red Lake Gas Storage System in Mohave Co., Arizona, a gas storage field composed of two subsurface solution mined salt cavities, 30 miles of 16 in. diameter gas pipeline, an onsite electric generator (over)

8. Type of applicant/recipient
A- State; B- Interstate; C- Substate District; D- County; E- City; F- School District; G- Special Purpose District; H- Community Action Agency; I- Higher Education Institution; J- Indian Tribe; K- Other
(Specify): Federal Agency
Enter appropriate letter [K]

9. Type of assistance
A- Basic Grant; B- Supplemental Grant; C- Loan; D- Insurance; E- Other
Enter appropriate letter(s) [C]

10. Area of project impact (Names of cities, counties, states, etc.): Mohave County, Arizona

11. Estimated number of persons benefiting

12. Type of application
A- New; B- Renewal; C- Revision; D- Continuation; E- Augmentation
Enter appropriate letter [A]

13. Proposed Funding

a. Federal	$	.00
b. Applicant		.00
c. State		.00
d. Local		.00
e. Other		.00
f. Total	$	.00

14. Congressional Districts Of:
a. Applicant
b. Project: 03

15. Type of change (For 12c or 12e)
A- Increase Dollars; B- Decrease Dollars; C- Increase Duration; D- Decrease Duration; E- Cancellation; F- Other (Specify):
Enter appropriate letter(s)

16. Project Start Date (Year month day) 19

17. Project Duration Months

18. Estimated date to be submitted to federal agency (Year month day) 19

19. Existing federal identification number

20. Federal agency to receive request (Name, city, state, zip code)

21. Remarks added ☐ Yes ☐ No

Section II - Certification

22. The Applicant Certifies That

a. To the best of my knowledge and belief, data in this preapplication/application are true and correct, the document has been duly authorized by the governing body of the applicant and the applicant will comply with the attached assurances if the assistance is approved.

b. If required by OMB Circular A-95 this application was submitted, pursuant to instructions therein, to appropriate clearinghouses and all responses are attached:

	No response	Response attached
(1) Arizona State Clearinghouse	☐	☒
(2) Region IV Clearinghouse (Dist IV)	☐	☒
(3)	☐	☐

23. Certifying representative
a. Typed name and title
b. Signature
c. Date signed (Year month day) 19

Section III - Federal Agency Action

24. Agency name
25. Organizational Unit
27. Administrative office
26. Application received (Year month day) 19
28. Federal application identification
29. Address
30. Federal grant identification

31. Action taken
- ☐ a. Awarded
- ☐ b. Rejected
- ☐ c. Returned for amendment
- ☐ d. Deferred
- ☐ e. Withdrawn

32. Funding

a. Federal	$	.00
b. Applicant		.00
c. State		.00
d. Local		.00
e. Other		.00
f. Total	$	.00

33. Action date (Year month day) 19
34. Starting date (Year month day) 19
35. Ending date (Year month day) 19
36. Contact for additional information (Name and telephone number)
37. Remarks added ☐ Yes ☐ No
38. Federal agency A-95 action
a. In taking above action, any comments received from clearinghouses were considered. If agency response is due under provisions of Part 1, OMB Circular A-95, it has been or is being made.
b. Federal Agency A-95 Official (Name and telephone number)

424-101

Standard Form 424 Page 1 (10-79)
Prescribed by GSA, Federal Management Circular 74-7

Section IV – Remarks (Please reference the proper item number from Sections I, II or III, if applicable)

5,400 horsepower of compression, appurtenant site access roads, and brine evaporation ponds. The facility would be designed to store 3 billion cubic feet of useable natural gas and to transport that gas through the proposed and existing pipeline facilities to customers in Arizona and southern Nevada.

TO:

Tim Barrow, Exec. Secretary
Utilities Division
Arizona Corporation Commission
1200 W. Washington
Phoenix, AZ 85007

FROM: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

State Application Identifier Number

SEP 21 1981 State A-P No. 81-80-0056

As. for Jobs & Energy
Corporation Comm.
As. Natural Heritage Prog.
Energy
Mineral Res.
Game & Fish
Transportation
Ag. & Hort.
Mine Inspector
Radiation Regulatory Agency
As Solar Energy Comm.
Oil & Gas Cons. Comm.

Power
Health
Water
Land
Parks

Region I

RECEIVED
SEP 24 11 AM '81
ARIZONA CORP COMMISSION
UTILITIES DIVISION

This project is referred to you for review and comment. Please evaluate as to the following questions. After completion, return THIS FORM AND ONE XEROX COPY to the Clearinghouse no later than 17 WORKING DAYS from the date noted above. Please contact the Clearinghouse at 255 5004 if you need further information or additional time for review.

☐ No comment on this project ☐ Proposal is supported as written ☒ Comments as indicated below

1. Is project consistent with your agency goals and objectives? ☐ Yes ☐ No ☒ Not Relative to this agency

2. Does project contribute to statewide and/or areawide goals and objectives of which you are familiar? ☒ Yes ☐ No

3. Is there overlap or duplication with other state agency or local responsibilities and/or goals and objectives? ☒ Yes ☐ No

4. Will project have an adverse effect on existing programs with your agency or within project impact area? ☐ Yes ☒ No

5. Does project violate any rules or regulations of your agency? ☐ Yes ☒ No

6. Does project adequately address the intended effects on target population? ☒ Yes ☐ No

7. Is project in accord with existing applicable laws, rules or regulations with which you are familiar? ☐ Yes ☐ No

Additional Comments (Use back of sheet, if necessary): This agency has the regulatory laws of public service corporation, fixed utilities. We find that there are two water utilities in a 18 miles radius of the project that pumps it's (over

Reviewers Signature: Gary L. Smith Date: October 6 1981

Title: Asst. Gas Safety Engineer Telephone: 255-4251

Comment reflected in section 2.A.1.

water supply from a water table below ground. We are concerned with the affect of the brine on the aquifers. The gas utility also is under the regulatory body of this Commission. We will regulate only the 30 miles of 16 inch diameter gas pipeline included in the project. This gas pipeline is of concern in regards to operation and maintenance during construction and during the full operation of the project. This is covered in 49 CFR 192 and A.R.R.R. 14-2-121.

CTC

RECEIVED
OCT 05 1981
STATE CLEARING HOUSE
OFFICE OF ECONOMIC
PLANNING & DEVELOPMENT

RECEIVED
SEP 2 1981
ARIZONA ...

TO:

Mr. James R. Carter, Director
Agriculture & Horticulture Dept.
421 Capitol Annex West
Phoenix, Arizona 85007

OCT 1 1981

81-80-0056

FROM: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Az. for Jobs & Energy	Power
Corporation Comm.	Health
Az. Natural Heritage Prog.	Water
Energy	Land
Mineral Res.	Parks
Game & Fish	
Transportation	Region IV
Ag. & Hort.	
Mine Inspector	
Radiation Regulatory Agency	
Az Solar Energy Comm.	
Oil & Gas Cons. Comm.	

This project is referred to you for review and comment. Please evaluate as to the following questions. After completion, return THIS FORM AND ONE XEROX COPY to the Clearinghouse no later than 17 WORKING DAYS from the date noted above. Please contact the Clearinghouse at 255-5004 if you need further information or additional time for review.

☒ No comment on this project ☐ Proposal is supported as written ☐ Comments as indicated below

1. Is project consistent with your agency goals and objectives? ☐ Yes ☐ No ☐ Not Relative to this agency

2. Does project contribute to statewide and/or areawide goals and objectives of which you are familiar? ☐ Yes ☐ No

3. Is there overlap or duplication with other state agency or local responsibilities and/or goals and objectives? ☐ Yes ☐ No

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5. Does project violate any rules or regulations of your agency? ☐ Yes ☐ No

6. Does project adequately address the intended effects on target population? ☐ Yes ☐ No

7. Is project in accord with existing applicable laws, rules or regulations with which you are familiar? ☐ Yes ☐ No

Additional Comments (Use back of sheet, if necessary):

No response required.

Reviewers Signature James R. Carter Date 9/28/81

Title Director Telephone 4373

243

Comments Form To Be Completed by Agency

TO:

State Application Identifier (SAI)

SEP 21 1981 State A.P. No. 81-80-0056

Department of Water Resources
Mr. Larry Linser
99 E. Virginia
[illegible], AZ 85004

FROM: Arizona State Clearinghouse
3rd Floor West Washington Street, Room 505
Phoenix, Arizona 85007

RECEIVED
SEP 21 1981
DEPARTMENT OF WATER RESOURCES

As. for Jobs & Energy	Power
Corporation Comm.	Health
As. Natural Heritage Prog.	Water
Energy	Land
Mineral Res.	Parks
Game & Fish	
Transportation	Region IV
Ag. & Hort.	
Mine Inspector	
Radiation Regulatory Agency	
As Solar Energy Comm.	
Oil & Gas Cons. Comm.	

This project is referred to you for review and comment. Please evaluate as to the following questions. After completion, return THIS FORM AND ONE XEROX COPY to the Clearinghouse no later than 17 WORKING DAYS from the date noted above. Please contact the Clearinghouse at 255-5004 if you need further information or additional time for review.

☐ No comment on the project ☐ Proposal is supported as written ☒ Comments as indicated below

1. Is project consistent with your agency goals and objectives? ☐ Yes ☐ No ☐ Not Relative to this agency

2. Does project contribute to statewide and/or areawide goals and objectives of which you are familiar? ☐ Yes ☐ No

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5. Does project violate any rules or regulations of your agency? ☐ Yes ☐ No

6. Does project adequately address the intended effects on target population? ☐ Yes ☐ No

7. Is project in accord with existing applicable laws, rules or regulations with which you are familiar? ☐ Yes ☐ No

Additional Comments (Use back of sheet, if necessary): 2A: PAR. 16. THE DWR DOES ISSUE WATER WELL PERMITS (MUST BE CARRIED BY LICENSED DRILLER), BUT DOES NOT ISSUE POTABLE WATER PERMITS. PAR. 16. DAMS 6 FT. OR MORE IN HEIGHT MUST BE REVIEWED BY ADWR. THIS ALSO APPLIES TO THE CONSTRUCTION [illegible]

Reviewers Signature Frank A. Davies Date 9/25/81

Title CHIEF PLANNING & FLOOD CONTROL DIV. Telephone 255-1516

2H4

Comment reflected in section 2.A.1.

Comment Letter No. 8: Commented that no response is necessary.

State Application Identifier (SAI)

SEP 21 1981 State A.P. No. 81-80-0056

TO:

Joe F. Fallini, Commissioner
State Land Department
1624 W. Adams, 4th Floor
Phoenix, AZ 85007
Attn: Robert Yount

FROM: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Az. for Jobs & Energy
Corporation Comm.
Az. Natural Heritage Prog.
Energy
Mineral Res.
Game & Fish
Transportation
Ag. & Hort.
Mine Inspector
Radiation Regulatory Agency
Az Solar Energy Comm.
Oil & Gas Cons. Comm.

Power
Health
Water
Land
Parks

Region 1

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☐ No comment on this project ☒ Proposal is supported as written ☐ Comments as indicated below

No response required.

1. Is project consistent with your agency goals and objectives? ☐ Yes ☐ No ☐ Not Relative to this agency
2. Does project contribute to statewide and/or areawide goals and objectives of which you are familiar? ☐ Yes ☐ No
3. Is there overlap or duplication with other state agency or local responsibilities and/or goals and objectives? ☐ Yes ☐ No
4. Will project have an adverse effect on existing programs with your agency or within project impact area? ☐ Yes ☐ No
5. Does project violate any rules or regulations of your agency? ☐ Yes ☐ No
6. Does project adequately address the intended effects on target population? ☐ Yes ☐ No
7. Is project in accord with existing applicable laws, rules or regulations with which you are familiar? ☐ Yes ☐ No

Additional Comments (Use back of sheet, if necessary):

Reviewers Signature Robert Yount Date 10/9/81

Title Land Manager Telephone 255-4625

245

Comment Form To Be Completed by Interested Agency

TO:

State Application Identifier (SAI)

SEP 24 1981 State A-95 No. 81-80-0056

Mr. Terry B. Johnson
Arizona Natural Heritage Progra
30 North Tucson Boulevard
Tucson, Arizona 85716

FROM: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

As. for Jobs & Energy
Corporation Comm.
As. Natural Heritage Prog.
Energy
Mineral Res.
Game & Fish
Transportation
Ag. & Hort.
Mine Inspector
Radiation Regulatory Agency
As Solar Energy Comm.
Oil & Gas Cons. Comm.

Power
Health
Water
Land
Parks

Region I

This project is referred to you for review and comment. Please evaluate as to the following questions. After completion, return THIS FORM AND ONE XEROX COPY to the Clearinghouse no later than 17 WORKING DAYS from the date noted above. Please contact the Clearinghouse at 255-5004 if you need further information or additional time for review.

☒ No comment on this project ☐ Proposal is supported as written ☐ Comments as indicated below

1. Is project consistent with your agency goals and objectives? ☐ Yes ☐ No ☐ Not Relative to this agency

2. Does project contribute to statewide and/or areawide goals and objectives of which you are familiar? ☐ Yes ☐ No

3. Is there overlap or duplication with other state agency or local responsibilities and/or goals and objectives? ☐ Yes ☐ No

4. Will project have an adverse effect on existing programs with your agency or within project impact area? ☐ Yes ☐ No

5. Does project violate any rules or regulations of your agency? ☐ Yes ☐ No

6. Does project adequately address the intended effects on target population? ☐ Yes ☐ No

7. Is project in accord with existing applicable laws, rules or regulations with which you are familiar? ☐ Yes ☐ No

Additional Comments (Use back of sheet, if necessary):

No response required.

Reviewers Signature Terry Johnson

Date Oct 2, 1981

Title Coordinator / ANHP

Telephone 327-0867

246

Comments of Items To Be Answered by Reviewing Agency

TO:

State Application Identifier (SAI)

SEP 21 1981 State A-95 No. 81-80-0056

Mr. Les Ormsby, Admin.
Arizona Power Authority
1810 West Adams Street
Phoenix, Arizona 85005

FROM: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Az. for Jobs & Energy
Corporation Comm.
Az. Natural Heritage Prog.
Energy
Mineral Res.
Game & Fish
Transportation
Ag. & Hort.
Mine Inspector
Radiation Regulatory Agency
Az Solar Energy Comm.
Oil & Gas Cons. Comm.

Power
Health
Water
Land
Parks

Region IV

This project is referred to you for review and comment. Please evaluate as to the following questions. After completion, return THIS FORM AND ONE XEROX COPY to the Clearinghouse no later than 17 WORKING DAYS from the date noted above. Please contact the Clearinghouse at 255 5004 if you need further information or additional time for review.

☒ No comment on this project ☐ Proposal is supported as written ☐ Comments as indicated below

No response required.

1. Is project consistent with your agency goals and objectives? ☐ Yes ☐ No ☐ Not Relative to this agency

2. Does project contribute to statewide and/or areawide goals and objectives of which you are familiar? ☐ Yes ☐ No

3. Is there overlap or duplication with other state agency or local responsibilities and/or goals and objectives? ☐ Yes ☐ No

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6. Does project adequately address the intended effects on target population? ☐ Yes ☐ No

7. Is project in accord with existing applicable laws, rules or regulations with which you are familiar? ☐ Yes ☐ No

Additional Comments (Use back of sheet, if necessary):

Reviewers Signature LO Ormsby Date 9/23/81

Title _____ Telephone _____

TO.

Bob Seare
Arizona Solar Energy
Research Commission
1700 W. Washington, Rm. 503
Phoenix, AZ 85007

FROM: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

State Application Identifier (SAI)

SEP 1 1981 81-80-0056

As. for Jobs & Energy
Corporation Comm.
As. Natural Heritage Prog.
Energy
Mineral Res.
Game & Fish
Transportation
Ag. & Hort.
Mine Inspector
Radiation Regulatory Agency
As Solar Energy Comm.
Oil & Gas Cons. Comm.

Power
Health
Water
Land
Parks

Region IV

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☒ No comment on the project ☐ Proposal is supported as written ☐ Comments as indicated below

1. Is project consistent with your agency goals and objectives? ☐ Yes ☐ No ☐ Not Relative to this agency

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5. Does project violate any rules or regulations of your agency? ☐ Yes ☐ No

6. Does project adequately address the intended effects on target population? ☐ Yes ☐ No

7. Is project in accord with existing applicable laws, rules or regulations with which you are familiar? ☐ Yes ☐ No

Additional Comments (Use back of sheet, if necessary):

No response required.

Reviewer's Signature [signature] Date 9/22/81

Title Assoc Director, ASEC Telephone 602/255-5668

248

TO:

Frank G. Servin, Exec. Dir.
District IV Council of Gov'ts.
1020 Fourth Ave., Suite 201
Yuma, AZ 85364

FROM: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

State Application Identifier (SAI)

SEP 21 1981 State A/P No. 81-80-0056

As. for Jobs & Energy	Power
Corporation Comm.	Health
As. Natural Heritage Prog.	Water
Energy	Land
Mineral Res.	Parks
Game & Fish	
Transportation	Region IV
Ag. & Hort.	
Mine Inspector	
Radiation Regulatory Agency	
Az Solar Energy Comm.	
Oil & Gas Cons. Comm.	

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RECEIVED
DIST. IV COG

☒ No comment on this project ☐ Proposal is supported as written ☐ Comments as indicated below

1. Is project consistent with your agency goals and objectives? ☐ Yes ☐ No ☐ Not Relative to this agency

2. Does project contribute to statewide and/or areawide goals and objectives of which you are familiar? ☐ Yes ☐ No

3. Is there overlap or duplication with other state agency or local responsibilities and/or goals and objectives? ☐ Yes ☐ No

4. Will project have an adverse effect on existing programs with your agency or within project impact area? ☐ Yes ☐ No

5. Does project violate any rules or regulations of your agency? ☐ Yes ☐ No

6. Does project adequately address the intended effects on target population? ☐ Yes ☐ No

7. Is project in accord with existing applicable laws, rules or regulations with which you are familiar? ☐ Yes ☐ No

Additional Comments (Use back of sheet, if necessary):

No response required.

Reviewers Signature [signature] Date 9-22-81

Title Executive Director Telephone 782-1556

249

Standard Form to be completed by the State Agency

State Application Identifier (SAI) SEP 21 1981 State A-95 No. 81-80-0056

TO:

Charles F. Tedford, Director
AZ Radiation Regulatory Agcy.
925 South 52nd St., Suite 2
Tempe, Arizona 85281

FROM: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Az. for Jobs & Energy	Power
Corporation Comm.	Health
Az. Natural Heritage Prog.	Water
Energy	Land
Mineral Res.	Parks
Game & Fish	
Transportation	Region IV
Ag. & Hort.	
Mine Inspector	
Radiation Regulatory Agency	
Az Solar Energy Comm.	
Oil & Gas Cons. Comm.	

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☒ No comment on this project ☐ Proposal is supported as written ☐ Comments as indicated below

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6. Does project adequately address the intended effects on target population? ☐ Yes ☐ No

7. Is project in accord with existing applicable laws, rules or regulations with which you are familiar? ☐ Yes ☐ No

Additional Comments (Use back of sheet, if necessary):

Reviewers Signature Charles F. Tedford Date 9/29/81

Title Director Telephone 255-4845

250

No response required.

State Application Identifier (SAI)

TO:

SEP 1 1981 81-80-0056

Donald E. Vaan, Exec. Director
Arizonans for Jobs & Energy
4747 N. 22nd Street
Suite 303
Phoenix, AZ 85016

Az. for Jobs & Energy
Corporation Comm.
Az. Natural Heritage Prog.
Energy
Mineral Res.
Game & Fish
Transportation
Ag. & Hort.
Mine Inspector
Radiation Regulatory Agency
Az Solar Energy Comm.
Oil & Gas Cons. Comm.

Power
Health
Water
Land
Parks

Region IV

FROM: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

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6. Does project adequately address the intended effects on target population? ☐ Yes ☐ No
7. Is project in accord with existing applicable laws, rules or regulations with which you are familiar? ☐ Yes ☐ No

Additional Comments (Use back of sheet, if necessary):

No response required.

Reviewers Signature Don Vand Date 9/22/81

Title Exec Dir Telephone 957-9844

251

ARIZONA STATE PARKS
1688 WEST ADAMS STREET
PHOENIX, ARIZONA 85007
TELEPHONE 602-255-4174

BRUCE BABBITT
GOVERNOR

STATE PARKS
BOARD MEMBERS

SAM RAMIREZ
CHAIRMAN
PHOENIX

A. C. WILLIAMS
VICE CHAIRMAN
PRESCOTT

DUANE MILLER
SECRETARY
SEDONA

PRISCILLA ROBINSON
TUCSON

CABOT SEDGWICK
NOGALES

GWEN ROBINSON
YUMA

JOE T. FALLINI
STATE LAND COMMISSIONER

MICHAEL A. RAMNES
DIRECTOR

ROLAND H. SHARER
DEPUTY DIRECTOR

October 19, 1981

Lonnie A. Lister
Project Manager
Federal Energy Regulatory Commission
825 N. Capitol Street, N.E.
Washington, D.C. 20426

RECEIVED BY
OCT 22 1981
ENVIRONMENTAL EVALUATION BRANCH

Re: Red Lake Salt Cavern
Gas Storage Project, DEIS

Dear Mr. Lister:

The Natural Areas Advisory Council (NAAC) has identified the following concerns in reviewing the Red Lake Salt Cavern Gas Storage Project, Draft Environmental Impact Statement. The initial proposal submitted by the Pataya Storage Company raised many questions concerning the project and, as was stated in the DEIS, the environmental staff of FERC was unable to provide all the necessary data to adequately answer those questions. Therefore, the feasibility and potential impact of the proposed project cannot be accurately evaluated until such information can be obtained and reviewed.

Discussion of the feasibility of the project pertained only to the proposed evaporation pond, which was analyzed in the precertification phase of the project. The second major unknown, as section 4.B.2 of the DEIS stated, is the suitability of the salt body at the proposed cavern site. This information will not be available until the cavern wells are drilled and tested, after FERC certification.

Specific concerns centered around the evaporation pond scheme. The NAAC questioned whether an alternative site for the ponds had been studied. Red Lake is one of two large closed basin playas in Arizona and is noticeably different from the larger, Willcox Playa. Very few studies have been conducted on Red Lake to determine it uniqueness and natural values. The geologic integrity of Red Lake should be protected until such studies can be completed. The presence of extensive cracks need to be investigated to determine their depth and potential access to the groundwater system. It is possible that substantial groundwater withdrawals could severely aggravate future cracking. Can the potential for future cracking as a result of groundwater withdrawals for this project be adequately assessed? No mitigating measures were suggested in the DEIS for preventing brine contamination of the groundwater system should future cracks appear.

Alternative sites for a similar pond have been discounted. The playa is a natural low-permeability area and, even though there is evidence of extensive cracking, construction of a brine pond at any other location in the valley would probably require expensive artificial liners.

Existing information is inadequate to predict the time and location of future cracking. The staff recommends monitoring, which should provide further insight into the cause and mechanism of crack formation. Other measures which would mitigate the potential for groundwater contamination are discussed in the FEIS.

Commercial uses for the salt obtained from the evaporation ponds should be encouraged. The feasibility of reducing the amount of unusable salt-clay residue to be permanently stored on site should be pursued. An evaluation of the possible impact of accumulated salts on the surrounding soils and vegetation should be made. Considering the intensity and duration of winds in the Hualapai Valley, salt from the ponds could be blown over a considerable area during the evaporation and harvesting periods.

Comment reflected in section 4.E.1 of the FEIS.

The NAAC agrees that if an evaporation pond is to be constructed on Red Lake the staff's alternative pond is superior to the

Since the applicant now proposes to remove all of the salt residue after abandoning the pond site, the long-term impact of permanent salt disposal is a null issue. Accordingly, the FERC staff has withdrawn its recommended pond design in favor of the environmentally superior alternative of total salt recovery.

proposed design. The alternative lessens the problems that could result from flooding. Again, the NAAC encourages the study of reducing the amount of residual salt that will be permanently stored once the ponds are abandoned. Additional information needs to be obtained on the nature and extent of the large-scale desiccation cracks and the imolications regarding the brine ponds and the groundwater system. There is very little data on the existing groundwater resources or on the soil properties for pond construction. Until such data can be reviewed it is difficult to assess the impact of this proposal.

Thank you for the opportunity to comment on this proposal. If you have any questions, please contact Tanna T. Baldwin, Natural Areas Coordinator, at this office.

Sincerely,

MICHAEL A. RAMNES
State Parks Director

A.T. Ellis

Dr. A.T. Ellis
Natural Areas Chairman

ATE:sto

Additional information has been obtained on the nature and extent of the large-scale desiccation cracks, the physical properties of the soil at the pond site, and the groundwater system. The staff's observations and conclusions are reflected in various revisions to the text. Several recommendations are made which would provide for continued impact analysis of the project, if approved, while mitigating the potential for extensive groundwater contamination.

RECEIVED BY
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ENVIRONMENTAL EVALUATION
STAFF

13 October 1981

Secretary, Federal Energy Regulatory Commission
825 North Capitol Street, N. E.
Washington, D. C. 20426

Dear Sir:

The following are my comments and questions on the Draft Environmental Impact Statement (Docket No. CP80-581) which concerns the proposed gas storage facility near Red Lake, Mohave County, Arizona. I offer these comments as a private citizen, but also as a limnologist with a research background that includes the study of playas and their ephemeral lakes in southeastern California during 1978-79.

1) Groundwater requirements for leaching salt: The DEIS estimate for necessary groundwater is 1.6 billion gallons (down from 1.86 billion gallons in FERC document--Docket No. CP80-581, dated 29 December 1980). Assumedly this estimate is derived from a salt body with known physical and chemical characteristics, yet to my knowledge no detailed analysis of removed cores has appeared and (DEIS, p. 122) no cores have been taken from the cavern site. Given the suggested water requirements and considering the salt to be NaCl, my calculations show the brine must be 60-65% saturated to remove the expected amount of salt. Is it feasible to expect a return brine of this concentration? Are their less soluble salts present e.g. gypsum or anhydrite, and, if so, are they taken into account in calculating the amount of groundwater needed?

2) Effects of groundwater withdrawal on playas: The DEIS (pp. 102-106) concern for the effects of additional groundwater pumping near Red Lake is certainly justified. Playas are very dynamic landforms, and they exhibit marked responses, both surface and subsurface, when their associated water tables fluctuate. If the FERC environmental staff is unaware of published reports on Western U.S. playas by J. T. Neal and W. S. Motts (see references following), I strongly urge these reports be consulted before the FEIS is written. Much information is provided on the formation of open fissures in playa surfaces attendant to groundwater lowering and reference to Red Lake (see e.g. Neal 1965a), including airphotos, is made. I would contend that current knowledge of the Red Lake groundwater system is inadequate to serve as baseline data, and that preliminary, as well as concomitant, aquifer testing should be implemented if the project is to be authorized.

When the staff issued its scoping notice in December 1980, preliminary data indicated that approximately 1.86 billion gallons of water would be required to solution mine the two gas storage caverns. Revised estimates now indicate that approximately 1.31 billion gallons would be required.

In November 1970, detailed analyses were performed on core samples taken from the El Paso well, approximately 1 mile east of the proposed site. (See figure 6 and appendix E.) These analyses suggest that the deposit consists primarily of sodium chloride, with only traces (less than 1 percent total) of calcium, magnesium, potassium, and sulfur. However, each storage caverr has been designed to accommodate more than 860,000 cubic feet of less soluble or insoluble materials at the bottom of the caverns. This represents almost 7 percent of the total volume of material proposed to be removed by solution mining.

Brine saturation will vary from low initial levels to much higher levels during the latter stages of cavern development. During the final stages, brine saturations in excess of 95 percent are projected. Some small fraction of the less soluble minerals present in the proposed cavern spaces would probably be dissolved along with the halite. However, dissolution of other minerals in the process would not limit or reduce the amount of halite capable of being dissolved per unit volume of water. Indeed, the ionic strength effect might increase the solubility of the halite and other minor constituents. If minerals other than halite were dissolved (rather than sinking to the cavern's sump, as anticipated), the amount of groundwater required to complete the proposed caverns could also decrease, though probably not significantly.

The FERC staff has studied these reports and other material available on the subject and has conducted an independent investigation of the cracks. The staff's observations and conclusions are reflected in the revised text. Additional aquifer testing has been undertaken, and the staff recommends post-certification monitoring.

3) Evaporation pond(s): The alternative DEIS evaporating pond is certainly far superior to the original proposal. However, I am not convinced that the additional sediment cover and deeper bury will permanently contain remaining salt. Clay-based playas have flat surfaces because wind-induced water movements cause extensive displacement of entrained sediments back and forth across the playa surface. I suspect that the 6" crown of compacted soil (DEIS, pp. 22-23) over the buried salt would be displaced by this wave action in time. A similar phenomenon occurs naturally in playas when phreatophyte mounds are leveled by water movements. Furthermore, the crown and additional soil cover will not prevent desiccation cracks from penetrating to the buried salt. If water reaches the salt and capillary action carries the resulting brine to the surface, changes in overlying sediments may result. This process occurs naturally in playas with shallow groundwater and produces large-particled, porous surficial sediments known as "puffy ground". It would result, upon continued wetting, in the solution and transport of the buried salt across the playa. An alternative to salt burial, that of induced salt evaporation, seems misrepresented in the DEIS. According to page 27, only 262,695 tons of salt could be produced by this process; yet 1.56 million tons result from natural evaporation (p. 11). The former figure assumes 3.4% solute concentration, while the latter (with 1.6 billion gallons of groundwater) requires 23.4% solute concentration by my figures. This discrepancy is, of course, relevant to my first question concerning the amount of groundwater necessary to remove 1.56 million tons of salt. Why can't the entire salt load removed by leaching be processed through vacuum-pan multiple effect?

Since the applicant now proposes to remove all of the salt residue following abandonment of the pond site, the long-term impact of permanent salt disposal is a null issue. Accordingly, the FERC staff has withdrawn its recommended pond design in favor of the environmentally superior alternative of total salt recovery.

Comment reflected in section 2.B.2. of the FEIS.

4) Wildlife use of the ephemeral Red Lake aquatic resources: The DEIS contends (p. 70) that waterfowl and shorebird use of the project area is very limited. I cannot attest to the extent of this usage on Red Lake, but I have witnessed large numbers of these birds on winter playa lakes in southeastern California. The California lakes support a diverse assemblage of aquatic insects and crustaceans (Kubly and Cole 1979), and these invertebrates are known to be important components in the diets of certain ducks (Krapu 1974, Swanson et al. 1974). As noted in the DEIS (pp. 72 & 97), the State of Arizona considers Red Lake to be of high scientific value. In fact, this playa is the only dry lake in the Mojave Desert within the state boundaries. Yet, the ephemeral aquatic ecosystem which forms on the playa has been given no consideration in the DEIS. To my knowledge no survey has been made of the aquatic species whose drought resistant stages reside in the dry lakebed.

It is true that no survey has been made of the aquatic species which might reside on Red Lake. However, as the DEIS stated, there is only limited use of the playa by waterfowl and shorebirds. Even that limited use should not be significantly affected, since the proposed evaporation pond would occupy only about 7 percent of the lakebed. Furthermore, the applicant's proposal and the staff's recommendations should ensure that salt is not released onto other parts of the playa during operation and after abandonment.

Since these invertebrates may well serve as food resources for migrating waterfowl and shorebirds, and they could be totally eradicated by a release of salts to the playa proper, I think it is imperative to survey these organisms and determine, at least to the extent that literature is available, their sensitivity to saline waters. Such a survey need not rely on the flooding of Red Lake as these organisms can be successfully cultured from dry sediments in the laboratory.

I would like to conclude by commending the FERC environmental staff which prepared the DEIS. In my opinion, it is a well prepared document. I hope that my comments are a help, rather than hindrance, in preparing the FEIS.

Sincerely,

Dennis M. Kubly

Dennis M. Kubly
Department of Zoology
Arizona State University
Tempe, AZ 35281

The comments and literature citations were helpful in refining the EIS analysis. The FERC environmental staff appreciates your recognition of its work.

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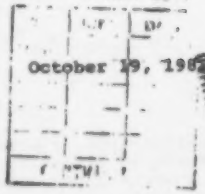

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FEDERAL ENERGY REGULATORY COMMISSION
Oct 22 11 36 AM '81

October 19, 1981

Secretary, Federal Energy
Regulatory Commission
825 North Capital Street, N.E.
Washington, D. C. 20426

Re: Red Lake Salt Cavern Gas Storage Project
Draft Environmental Impact Statement
Pataya Storage Company
Docket No. CP80-581

Gentlemen:

On behalf of John Neal and Evalee Neal, his wife, comment is herein made with respect to a specific portion of the Draft Environmental Impact Statement above-referred to. Figure 2 entitled "Proposed Facilities" which appears at page 6 of the Draft Environmental Impact Statement reflects a proposed access road which would cross Sections 19, 21, 22, 23 and 24 of Township 26 North, Range 16 West, Mohave County, Arizona. John Neal and Evalee Neal, his wife, are the owners and operators of a cattle ranch situated in the area of the aforementioned access road. With respect to Sections 19, 21 and 23, which have been subdivided and are privately owned, Neal, et ux, have reserved grazing rights which permit them to graze livestock on such sections. With respect to Sections 22 and 24, which are owned by the Department of the Interior and managed by the Bureau of Land Management, Neal, et ux, have grazing permits. Neal, et ux, own twenty-eight (28) lots in Section 23 and in the Southeast corner of Section 23 are the owners of twenty-eight (28) subdivided lots. The proposed access road would be adjacent to the corrals and watering facilities utilized by Neal, et ux, in the Southeast corner of Section 23.

The route of the proposed access road would cross a portion of the Valley where the best grass land is located. Additionally, by reason of the better forage in the area, there is a

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The staff notes that while the suggested alternative would require only 1 extra mile of access road construction, the total distance to the plant site (assuming project traffic on Antares Road approaches from the south) would be approximately 5 miles longer than the proposed route.

The staff understands that, since receipt of this letter, a revised alternative has been proposed by the commentor to the BLM, which must issue a right-of-way grant for the access roads. This alternative route would go east from the plant site 1 mile along the applicant's proposed route, then northeastward, approximately 1.4 miles to the intersection of sections 14, 15, 22, and 23, T.26N., R.16W., then east again to Antares Road. The FERC staff has no objections to this revised alternative route.

higher concentration of livestock grazing and livestock use in the area of the proposed access road than would be true in other vicinities particularly to the North of the proposed access road. Additionally, vehicle traffic on the proposed access road would substantially and materially interfere with the use by Neal, et ux, of the corrals and watering facilities which are necessary to the course of proper management of their livestock. The damage that would necessarily result from vehicle traffic on the proposed access road would have a serious effect on vegetation in the area and destruction of existing vegetation would bring about erosion problems that do not currently exist.

The proposed access road would be approximately five miles in length. As an alternate to the proposed alignment of the proposed access road, the utilization of a route across Sections 20, 17 and 8 in a Northern direction and then coursing East on Sections 4, 3 and 2, all in Township 26 North, Range 16 West, would furnish access to the Antares Road across Sections managed by the Bureau of Land Management and would not involve privately owned land with the exception of Section 17, which is owned by a subsidiary of Southwest Gas Corporation. This suggested alternate route lies within an area that is not nearly as productive from a forage standpoint as the area where the proposed access road is reflected on the Figure 2 and would thus not be particularly damaging to the current Neal livestock operation. Furthermore, the suggested alternate route, environmentally, is a more acceptable route since it would create less damage to existing environment.

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It is believed that the difference in length between the access route shown in Figure 2 and the proposed alternate route set forth in this letter of one mile is not a sufficient economic deterrent when measured against the impact on the environment to create a substantial burden for the applicant.

It is the understanding of Neal, et ux, that Roger Taylor, the Area Manager of the Bureau of Land Management located at Kingman, Arizona, has voiced a protest with respect to the above alignment of the proposed access road predicated largely upon the reasons set forth in this letter. It is hoped that the applicant will be required to give further study to the access road alignment to the end that the proposed alignment will ultimately be changed to coincide with the alternate route proposed in this letter.

Very truly yours,

Keith F. Quail

KEITH F. QUAIL

KFQ/dl

cc: John Neal

*U.S. GOVERNMENT PRINTING OFFICE: 1982-0-377-935/8390